

Tally[®]

T5023/5023+

Programming Guide



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Preface



This programming manual describes in the main the instruction set of the multi-functional flat bed printer. The document printer is a workstation printer with one printing point and is used to process documents and passbooks. The printer can be fitted with a magnetic stripe reader (MSR) as an option.

This manual is intended for all users, who wish to create their own programs, for example, for document or passbook processing . Detailed technical data, operating information (for example, connecting the printer, inserting the paper, etc.), and maintenance instructions are in a separate operating instruction.

Fault elimination information is in the appendix of this manual.

Conventions

Following conventions are made in this manual:

Courier	System outputs, such as error messages, information, notes, file extracts
Courier Bold	Example of user inputs
–	Indicates a list.
●	Indicates a specific sequence must be followed.
„“	Refers to other chapters or sections.
☺	Marks functions which have to be preferred. All functions without this sign are only mentioned for compatibility reasons, they should only be used by exception.
	General informations, notes and tips.
	Warning notes, which have absolutely to be followed.

Abbreviations

APA graphics	All Points Addressable graphics
APR	Automatic Passbook Reader
CS	Character Set
DQ	Draft Quality
IF	Interface
LQ	Letter Quality
MSR	Magnetic Stripe Reader
MICR	Magnetic Ink Character Recognition
CSI	Control Sequence Introducer
LSB	Least Significant Bit
MSB	Most Significant Bit
OCR	Optical Character Recognition printer fonts

Use of the manual

This manual describes printer programming for various document processing applications.

All program examples in this manual are independent of programming languages (pseudo code). Particulars for the conversion of pseudo code instructions into a programming language (special BASIC dialects, COBOL, C, etc.) will not be dealt with here. Likewise, particulars of the communication protocol between the document printer and the connected computer are not taken into account.

Contents of the manual

Chapter “Short description of the document printer“

This chapter briefly lists the hardware components of the document printer and outlines the application areas of the printer.

Chapter “Programming interface (General)”

This chapter outlines the basic principle of logical communication between an application and the printer via ESC sequences. The functions of the multifunctional document printer are described using examples.

Chapter “Standard commands”

All the Epson- compatible control commands of the document printer are described here. Exceptions are the character set and graphics commands, which will be explained in subsequent chapters.

In particular, the commands for the following application areas are described:

- Controlling the configuration of the printer
- Setting the page and line constants
- Vertical and horizontal tabulation
- Setting the print quality and the character size
- Highlighting parts of the text by setting a suitable print mode (e. g. bold print, underlining, superscript, subscript, etc.).

Chapter “Character set commands”

The emphasis of this chapter is on the setting of characters defined by the user with the description of the relevant commands. In addition, the commands for switching over between character sets are described (for example, standard character set, graphics character set, national character sets).

Chapter “Graphics commands”

This chapter describes commands used to print drawings, diagrams or pictures as dot graphics. The basic principle is to encrypt the individual picture dots as a series of numbers and to transfer them to the printer.

Chapter “Additional commands”

This chapter explains special control commands for document processing or for processing ZeKoSa data. An important application area for the commands described here is the processing of passbooks. This also contains important information on processing documents using horizontal and vertical print positioning.

Chapter “Application examples”

A small program example of command functions normally belongs to the command descriptions in the chapters “Standard commands”, “Character set commands”, etc.

The chapter “Application examples” uses more complex operations to explain the use of specific commands in connection with:

- Text processing with the document printer
- Passbook processing with MSR.

Individual program steps are annotated in detail and the program structure is presented in the form of a pseudo code.

Chapter “Loadable Firmware/Character Generators”

Firmware and character generators of the document printer are stored in a programmable memory with FLASH technology. The chapter "Loadable Firmware/Character Generators" describes the sequence of load processes and the bootstrap loader ESC sequences.

Chapter “Controlling Asian Character Sets”

Asian character sets must be made available for the specified printers to prepare the document printer for its usage in the Asian area. This chapter provides a description of the control of the Asian character sets.

Chapter “Specific Operating System Dependencies”

This chapter describes specific operating system dependencies.

Chapter “Glossary”

Special terms are explained in this chapter.

Appendix

The appendix of this product manual contains the following information:

- List of all document printer commands
- Character set tables
- Printable document and paper versions/ paper specification
- Table of error messages
- Description of the physical interface

Chapter “Index“

Facilitates searching for selected terms.

Short description of the document printer

The document printer has a document printing point with which single documents, multiple documents (sets of forms) and passbooks can be processed. The printer can also be equipped with a magnetic stripe reader (MSR), a magnetic ink card reader (MICR) or a single sheet feeder as an option.

Document printing point

The term 'document' includes all single documents, for example, cheques, unprinted DIN A4 papers (blank documents), forms of various sizes or passbooks.

All documents are fed by the document printer over a flat bed according to the principle of single- sheet processing, are processed and ejected again. The processing of a document is begun when each single document is put forward.

The form feed of the documents can be freely selected. The feeding of the documents is supported by an automatic alignment. The print characters can be positioned relative to all the document edges.

The following provides a comprehensive list of the characteristics of the document printing point:

- 90 printing points with 10 characters/ inch
- Automatic document alignment
- Automatic print head adjustment
- Automatic document edge detection
- Print head with 24 needles
- 2 print modes (LQ, Draft)
- '24- bit' and '8- bit' graphics
- The print rate is dependent on the horizontal density of the character font selected in each case. There are two different print rates for the print modes LQ (Letter Quality) and Draft. The document printer can also process type fonts, print qualities or multi- phase characters, which vary from the pixel data structure of the standard character sets. More than two print rates are possible due to the respective character font.

Options

Magnetic stripe reader (MSR)

As an option, the document printer can be delivered with a magnetic stripe reader (MSR device) for passbooks. This enables reading and updating from the magnetic stripe on passbooks depending on certain recording modes (DIN / IBM). It is possible to change between various recording modes via the program.

MICR

Magnetic ink character reader for the fonts CMC7 and E13B.

Feeder

Single sheet feeder for 500 sheets A4.

Memory extension

The memory extension is necessary e.g. for journal data or asiatic fonts.

System interface

Data, which activates the functions of the printer is transferred through the system interface. The interfaces has the following characteristics:

- the physical connection
- the logic protocol (command sequences)

The characteristics are selected via the operating panel.

Physical interface

Two interfaces are available:

- internal interface (RS232)
- optional (external) interface (Centronics, LAN, etc. in combination with a correspondent additional logic).

Logical protocol

Several protocols (emulations) are available. Dependent on the loaded firmware configuration the following selection is possible:

Firmware configuration '5023_STD'

- Epson ANSI
- IBM 4722
- Proprinter XL24

Firmware configuration '5023_OLI'

- Epson ANSI
- Olivetti
- Proprinter XL24

Epson ANSI

The manual describes detailed this emulation. As all functions of the printer are supported optimal, this emulation should be used for the realisation of new applications. Also this emulation can be used for the removal of the following printers:

- EPSON ESC P
- ND 90
- HPR 4904
- HPR 4905

IBM 4722, Proprinter XL 24, Olivetti

This emulations copy printers of other producers (partially with restrictions). In this manual only the command table, specialities, parameter settings and possible incompatibilities are described.

Application areas

The processing of single/multiple documents and passbooks allows the use of the document printer in the following areas:

Industry and commerce:

- Delivery notes
- Freight and customs papers
- Invoices
- Envelopes

Public authorities:

- Application forms
- Filing cards
- Tax cards
- Motor vehicle papers
- Driving licences

Banks, Insurances and Services:

- Passbooks
- Cheques
- Transfers
- Medical certificates
- Application forms

Magnetic stripe writing and reading equipment is available for use in banks as an option.

Programming interface (General)

This chapter contains general information on how the functions of the document printer can be activated by a user program, i. e., how the document printer can be programmed. This chapter also explains the functions which can be activated by means of the program in a short, comprehensive summary.

Encryptions/Codes

The print functions of the document printer are initiated from a program in which unique numeric encryptions (codes) representing characters and commands are transmitted from the computer to the printer. The individual codes stand for printable characters (letters, numbers, punctuation marks, mathematical symbols) or control codes, which cause certain actions (for example, document ejection, deletion of characters, carriage return).

ASCII code

A code table specifies how the printable characters and control commands, for example, for document ejection and carriage return are encrypted binarily in the computer or printer. The encryption is expressed by a corresponding hexadecimal or decimal number. A certain character then lies in hexadecimal notation or in the decimal representation, for example, in the range hex 00 to hex FF or decimal 0 to decimal 255 (8- bit encryption).

Examples:

Character	Meaning	Decimal	Hex
A	Letter big A	65	41
a	Letter small a	97	61
4	Number 4	52	34
LF	Line Feed	10	0A
ESC	Escape	27	1B

With the document printer and with most computers the basis for the encryptions is the code system ASCII (**A** merican **S** tandard **C** ode for **I** nformation **I** nterchange), which only differs in certain characters for special foreign languages (national ASCII table). The ASCII code is encrypted via 7 bits, whereby 128 different meanings are possible.

Escape sequences / CSI sequences

As the ASCII table provides fewer control codes than print functions, the commands for the printer normally consist of a sequence of two or more ASCII characters. Such a code sequence is always preceded by the encryption of the control code ESC (Escape) (ASCII code 27 (decimal) or 1B (hexadecimal)). This signals to the printer that the encryptions following ESC are to be interpreted as commands for the printer.

There are two kinds of code sequences for the document printer:

- ESC ...
Code sequences, which begin with ESC or the appropriate encryption, are called ESC sequences.
- CSI ... = ESC [...
Code sequences introduced with CSI (Control Sequence Introducer) are called CSI sequences. CSI sequences are introduced with encryptions of the character sequence "ESC [" and concluded with the encryption of two

characters depending on the command I (= Intermediate Character) and F (= Final Character). The CSI sequences are used to control special document printer functions for document and MSR processing (see “document printer specifications” in this chapter and the chapter “Additional commands”).

Examples (ESC sequences):

ESC sequence	Meaning	ASCII encryption
ESC 4	Italic print on	decimal : 27 52 hexadecimal : 1B 34
ESC 5	Italic print off	decimal : 27 53 hexadecimal : 1B 35
ESC 0	Deleting bottom margin	decimal : 27 79 hexadecimal : 1B 4F
ESC C 60	Setting the document length to 60 lines	decimal : 27 67 60 hexadecimal : 1B 43 3C

Examples (CSI sequences, here without encryptions):

CSI	Parameter	I	F	Meaning
ESC [		%	r	Deleting of MSR track (no parameters)
ESC [	n	\$	t	Activating passbook processing

Activating the document printer functions

The control codes or ESC or CSI sequences must be addressed to the printer directly and uniquely via corresponding program commands. Depending on the respective programming language, this is, e. g., via PRINT or WRITE instructions.

Example:

Three lines are to be printed. Lines 1 and 3 are printed in normal print, line 2 in italic print.

Pseudo code:

```
BEGIN
  PRINTLF(" first line")
  PRINT(ESC 4)
  PRINTLF(" second line")
  PRINT(ESC 5)
  PRINTLF(" third line")
END
```

Conversion into BASIC:

```
10 LPRINT "first line"
20 LPRINT CHR$(27);" 4";
30 LPRINT "second line"
40 LPRINT CHR$(27);" 5";
50 LPRINT "third line"
```

Result:

```
first line
second line
third line
```



In this manual the program examples are depicted exclusively in the form of a pseudo code and the control codes or code series are given in decimal ASCII encryption or directly as characters. The corresponding information must then be converted into the appropriate programming language.

Print effects

The design of a print product is dependent on the print quality, type font, type size or character width and highlighting text, e. g., by underlining or bold print.

Print quality

The print quality is characterized by the density of the print characters and by the print rate. The document printer provides two print qualities:

- LQ mode (Letter Quality)
The LQ mode has the higher print quality and lower print rate.
- DQ mode (Draft Quality)
The DQ mode has a lower print quality, but a higher print rate.

Example:

```
This line is printed in LQ mode.  
This line is printed in DQ mode.
```

The print quality can be selected by means of the corresponding ESC sequences via a program or the menu.

Fonts

In addition to the DQ font for drafts, the default fonts Roman, Sans Serif, OCR A (OCR A1 Eurobanking) and OCR B (OCR B1 Eurobanking), as well as the character set ISO 8859 with the following versions are available for Letter Quality (LQ mode):

- East Europe
- Cyrillic
- Greece
- Hebrew
- Tur key

The DQ, Roman and Sans Serif fonts are selected via corresponding ESC sequences in the program.

The OCR- A, OCR- B and ISO 8859 fonts, as well as all special, non- Epson-compatible fonts, can only be selected via CSI sequences. The character fonts thus selected are treated like normal LQ type fonts, this means that all standard commands (print quality, character size, print type) are also effective for these fonts.

Example (fonts in Letter Quality):

```
This is the type font Draft.  
This is the type font Roman.  
This is the type font Sans Serif.  
0123456789JHY This is OCR-A.  
0123456789 This is OCR-B.
```

Font size / character density

The width of a printed character is expressed in 'characters per inch' (cpi) and is often called 'character density', for example

10 characters per inch = 10 cpi

The document printer can print in the character widths 10, 12 and 15 pitch. Each individual character is then the same width.

Example:

```
character width 10 cpi
character width 12 cpi
character width 15 cpi
```

The font size can also be influenced by proportional type, as well as by elongated or condensed print.

Proportional type

With proportional type each character takes up a different amount of space according to its size (for example, 'l' takes up less space than 'B' or 't' less than 'g'). Texts in proportional type are normally shorter than in normal print.

Example:

```
Text in normal print
Text in proportional type
```

Elongated print

With elongated print, each character is represented in double width. It is possible, for example, to highlight page headings in a text.

Example:

```
standard print
elongated print
standard print
```

Condensed print

If printing takes place in 10 or 12 pitch in condensed print, each character can be reduced to 60% of its width in normal print.

Example:

```
standard print  
condensed print  
standard print
```

Highlighting text

The following print functions of the document printer can be influenced by corresponding ESC sequences:

- Double impact print/ bold print
- Underlining
- Superscript/ subscript
- Double Superscript

Double impact print / bold print

With double impact print (= vertical bold print) the print head goes over each line twice. The paper is transported 1/180 inch after the first print and the same characters are printed again vertically and slightly displaced.

With bold print (also called horizontal bold print) each dot of a character is printed twice, whereby the second dot is displaced slightly to the right of the first dot printed.

In double impact print, the space between the dots is filled up, in (horizontal) bold print, the lines of a character are intensified. Bold and double impact print can be combined so that particularly bold characters result.

Example:

```
standard print
double impact print
double impact print in LQ print quality
bold print and double impact print in LQ print quality
```

Underlining

Certain parts of a text can be highlighted by switching the underlining mode on and off.

Example:

```
Certain parts of the text can be
highlighted by underlining.
```

Superscript / subscript

Footnotes, equation or special text designs are possible by switching superscript and subscript on and off.

Example::

Chemical formula for water: H₂O.

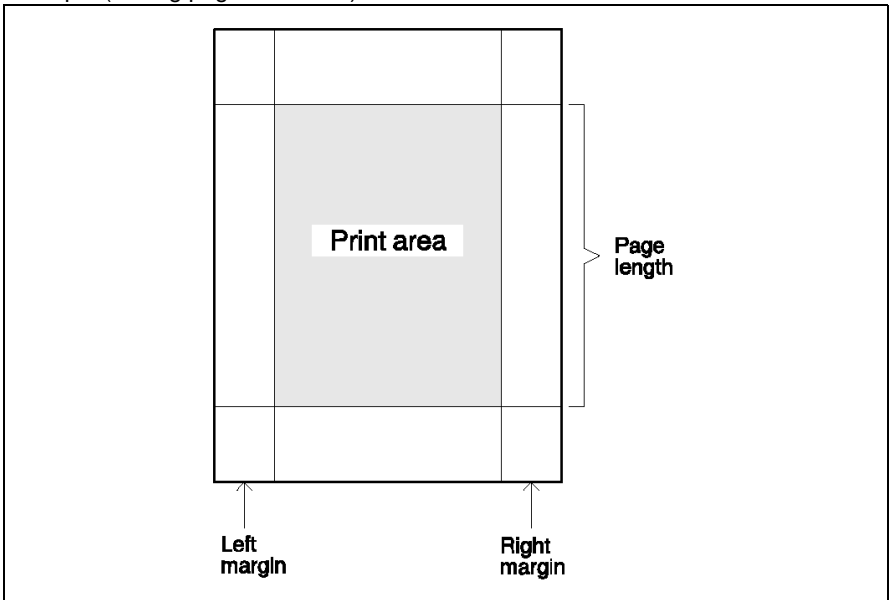
Theory of Pythagoras : a² + b² = c².

Page layout

By means of appropriate ESC sequences the page design can be influenced or the text output controlled on the basis of pre-printed forms. This includes, for example:

- Setting and deleting horizontal and vertical tabs
- Setting the width of a printed page
- Setting the line spacing
- Presenting a text flush left, flush right, centered or with margin justification.

Example (setting page constants):



Example (Text adjustment):

```
This text is adjusted flush  
left.
```

```
The following lines are adjusted flush  
right:
```

```
                32,456 $  
                214 $  
            123,456,346 $
```

```
                Centered text
```

```
This text is printed with margin  
justification, i.e. flush left and flush  
right.
```

Example (line spacing):

```
line spacing 1/8 inch  
line spacing 1/8 inch  
line spacing 1/6 inch  
line spacing 1/6 inch  
line spacing 1/4 inch  
line spacing 1/4 inch
```

Character tables

Two areas are differentiated with the printable characters in a code table:

- Area with the basic character set of each type font (Draft standard type, Roman, Sans Serif). This area is also called the 'basic character table'. The characters of the basic character table are encrypted in ASCII by the codes hex 20 to hex 7F (decimal 32 to 127).
- Area with italic characters, special characters, graphics characters or characters defined by the user. This area is also called the 'upper character table'. The characters in the upper character table are encrypted in ASCII with the codes hex 80 to hex FF (decimal 128 to 255).

The italic character set contains a basic character table (hex 20 to hex 7F) and an italic character table (hex A0 to hex FF). The area hex 80 to hex 9F is not utilized. In the graphics character set the upper character table contains special graphics characters in the area hex A0 to hex FF. In the extended graphics set the upper character table additionally contains characters in the area hex 80 to hex 9F.

It is possible to switch over the various character sets at any time via a program by means of appropriate ESC or CSI sequences.



The program can be switched to different fontpages by ESC sequences. You can find the available codepages in the appendix.

National character sets

By selecting a national character set, characters used in other languages are additionally available to the user. The selection of national character sets results via an ESC sequence or via the operating panel of the printer. These characters replace in each case the corresponding encrypted characters in the basic character table.

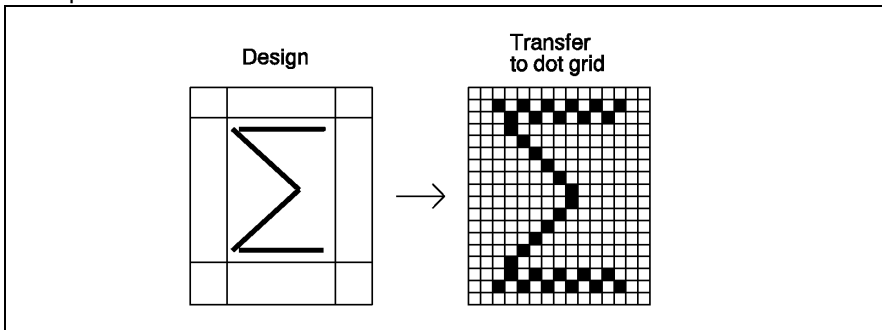
Examples:

Code	Basic character	Italy	Japan	Norway
5B	Ä	.	[	Æ
60	,	ù	`	é
7C	:	ò	|	o

Characters defined by the user in character tables

Symbols stored in character tables are printed on the basis of the respective character code and the assigned dot pattern.

Example:



By means of certain ESC sequences any dot patterns can be defined anew and assigned to a code of the basic character table. For example, a new alphabet, symbols specific to a subject or individual graphics characters can thus be produced and printed instead of the standard character in each case.

The definition of such characters specific to the user will be dealt with in a separate section. In principle the production of a new character or symbol is the production of a graphics pattern, for which the printer needs exact details as to

Document printer specifications

Business procedures or transactions in a financial institution involve a series of manual and program activities, e. g., the insertion and removal of documents and passbooks or the entry of deposits and withdrawals, bank code and account number. These processes are supported by special banking periphery and the appropriate programs. The printer processing includes, for example, voucher prints on documents and passbooks.

Standardly or optionally the document printer has features with which

- documents or passbooks can be processed
- magnetic stripes can be read and written on.

Additional special commands are available for programming:

- positioning commands
- control signals
- control of the MSR functions
- special functions.

The analysis of the document printer responses, which provide information about the present status of the printer or contain data on the program, is also relevant here:

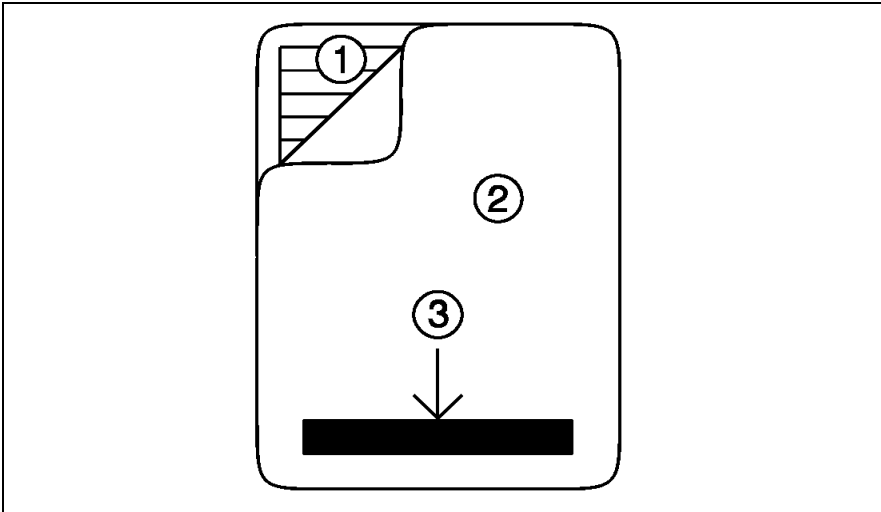
- status of the printer after the appearance of exceptional conditions like errors, operating interruptions or operating panel entries (status signals of the printer, which can appropriately be acted upon in the program)
- receiving requested data.

Magnetic stripe processing

The device called MSR is used for processing magnetic stripes on passbooks. The MSR equipment allows an automatic reading and updating of data in encrypted form.

In what form the appropriate data is encrypted on a MSR magnetic stripe depends on the respective recording mode (DIN/IBM).

Example (magnetic stripe on the back of a passbook):



- 1 Inside of passbook
- 2 Back of passbook
- 3 Magnetic stripe

Here the magnetic stripe could contain the following information:

- Next or last line to be printed in the passbook
- Account number of the customer
- Balance (credit) of the customer.

Via the reading of the magnetic stripe, the entry of this data becomes unnecessary. The values for the line number and the balance are updated on the magnetic stripe before the printing of the passbook line.

Special features of the document processing

When processing documents, in contrast to the normal processing of single sheets or continuous forms, the varying sizes of the documents and the document feeding mode must be considered.

Insertion and ejection of documents

In principle there are two possibilities for controlling the insertion and ejection of documents.

One possibility is that the printer initiates an insertion automatically at a holding position (set if necessary by appropriate commands), when a document is fed in by the user. When the first print or positioning command for this document is recognized, it will be drawn in and transported to the correct processing position. If the document printer receives print instructions and no document is available, the user will be requested to insert a document by a flashing LED indicator and the LCD display on the operating panel.

The ejection of a document can be initiated by a form feed command.

Using a special CSI command, documents can also be drawn in explicitly to the base of the first print line and processed; or documents only fed in can be ejected. Thus insertion and ejection procedures can be secured by means of separate control cycles in the program.

Standard commands

This chapter describes all Epson-compatible commands (ESC sequences). Commands for changing character sets (see “Character set commands”) and commands with which graphics can be created (see “Graphics commands”) are not included here. Special commands (CSI sequences) for document processing or for processing MSR data are described in the chapter “Additional commands”.

Notes about command description

The following first explains how the respective ESC sequence for a command is described and of which components this description consists. An explanation regarding the interpretation of the pseudo code instructions in the program examples then follows. A note is then given on how the commands normally behave when incorrect command parameters are transmitted.

All notes given in this section also apply for the “Character set commands” chapter and “Graphics commands” chapter and with variations also for the “Additional commands” chapter.

Description components

The description of the standard commands is divided into the following components:

- Command name with ASCII coding in hexadecimal and decimal encryption
- Description of function and usage
- Additional notes on requirements, options and connections with other commands
- Normally each command description is concluded with a short example through which the usage and effect of the command is demonstrated.

Example of a formal command description (command syntax):

ESC	A	(n)	ASCII character	①
27	65	n	Decimal	②
1B	41	n	Hexadecimal	③

- ① Command name/ESC sequence
- ② Decimal encryption according to ASCII table
- ③ Hexadecimal encryption according to ASCII table

Coding of decimal command parameters

All command parameters n or n_1 , n_2 , etc. in the ESC sequences of the Epson-compatible commands must be transferred to the document printer in binary coded form and not as ASCII characters. Several parameters are simply transferred consecutively without separation characters (e. g. space or comma). The binary coding of a parameter must be implemented in the user program by means of a corresponding ASCII coding in hexadecimal or decimal encryption. In the command syntax parameter values to be coded binarily are bracketed in the first line (for example, (n) or (n_1) , (n_2) (n_3) ...). In the subsequent lines with the hexadecimal or decimal encryption of the command, the parameter descriptions n , n_1 , etc. are repeated without brackets as variables for concrete values. Which values a parameter can have are specified in the subsequent function description.

Example:

Determining the document length at n inches

ESC	A	① (n)	ASCII character
27	65	n	Decimal
1B	41	n	Hexadecimal

Function:

ESC C NUL(n) sets the document length at n inches (absolute document length independent of the line spacing). The value n must be between 1 (inch) and 22 (inches). ②

- ① Parameter value of n must be encrypted binarily
- ② Note on which values the parameter n can have

i

In contrast to the ESC sequences of the standard, character set and graphics commands for the document printer- specific additional commands (CSI sequences), the command parameters n, n1, etc. are coded as ASCII values. For example, three bytes are transferred for a three- figure parameter value n = 123 (see “Additional commands” chapter).

Program examples

All instructions in the program examples to demonstrate the standard control commands are represented independently of a certain programming language. This is done by formulating the program lines in a colloquial pseudo code. In practice, this pseudo code, depending on the programming language used, must be converted into the appropriate program instructions.

Example:

```

BEGIN
  PRINTLF("Print page with bottom margin")
  CALL LINE PRINT
  PRINT(char(27),"O")
  PRINTLF("Print page without bottom margin")
  CALL LINE PRINT
END

BEGIN LINE PRINT
  SET N = 0
  REPEAT
    SET N = N + 1
    PRINTLF("Line", N,"after title")
  UNTIL N = 6
END LINE PRINT

```

Explanation of the pseudo code instructions:

	Function	Coding
1	Instruction block	BEGIN/END
2	Loop	REPEAT/UNTIL abort criterion
3	Alternative	IF...THEN...ELSE ...
4	Initializing	SET variable = value
5	Changing variable value	SET variable = variable +/- value
6	Subprogram call	CALL subprogram name
7	Printing without line feed	PRINT (arguments)
7	Printing with line feed	PRINTLF (arguments)
7	Control characters	char(x) or char(a,...,n)
8	Evaluation of printer response (read data)	GET (arguments)

(Further explanations on 1, 2, ... , 8 see next pages)

- 1 When defining subprograms, after BEGIN and END the subprogram name is specified (for example, BEGIN LINE PRINT ... END LINE PRINT).
- 2 The instruction within REPEAT ... UNTIL (loop body) are executed until the abort criterion specified after UNTIL is fulfilled (for example, REPEAT ... UNTIL N = 6). This pseudo code instruction is defined here in such a way that the loop body is not executed if the abort criterion is already fulfilled before the first loop run.
- 3 (for example, IF N = 50 THEN BEGIN ... END or IF n = 50 THEN CALL NEW PAGE ELSE N = N+ 1)
- 4 (for example, SET N=0)
- 5 (for example, SET N=N+1)
- 6 (for example, CALL LINE PRINT)
- 7 The data transmission from the program to the document printer is to be symbolized by means of the procedures PRINT and PRINTLF. Depending on the arguments, these are control commands (character(...)) or alphanumeric or numeric user data. No carriage return (CR) is executed via the procedure PRINT. A line feed (LF) and also a carriage return (CR) are defined via the procedure PRINTLF. Depending on whether the printer parameter 'AUTO- CR + LF' (= CR- HANDLING in the document printer menu) is activated or not, the real conversion of the PRINTLF procedure must be programmed accordingly.

The following values occur as arguments of PRINT and PRINTLF:

Argument	Meaning
"x"	Code of a printable character x from the sequence ESC ... X ...
character (x)	x := decimal encryption of an ASCII value or x := value of a parameter n, m, etc., which is to be coded binarily
character (a, b,..., n)	char(a), char(b), ..., char(n)
"text"	string of text/character chain
A, B, C,..., N or counter, page, pass, etc.	numeric or alphanumeric variables in the form of capital letters or speaking names such as "counter", "page", etc.

On 'x':

For example, C as printable character can be specified directly by means of 'C' in the sequence **ESC C NUL (n)** or by means of **char (67)**, whereby 67 is the decimal ASCII encryption of C.

Examples on char(x):

- char(27) with 27 = decimal encryption of ESC
- char(4) with 4 = value of n

for example, from the sequence ESC C NUL (n)

- 8** The procedure GET (arguments) should symbolize the data transmission from the document printer to the program. This procedure is only relevant for the description of certain CSI sequences in the "Additional commands" chapter, with which responses from the printer can be evaluated.

Examples:

The command for line feed is LF and is encrypted decimally according to the ASCII coding by '10'. Equivalent to this are the pseudo code instructions:

```
PRINT("This is a line", char(10))
PRINTLF("This is a line")
```


Setting the document length (for example, 6 inches = ESC C NULL 6):

```
PRINT( char(27,67,0,6))  
or  
PRINT( char(27),"C", char(0), char(6))
```

Initializing the printer after printing with line feed:

```
PRINT("text", char(10), char(27),"@")  
or  
PRINT("text")  
PRINT(char( 10))  
PRINT(char( 27),"@")  
or  
PRINTLF("text")  
PRINT(char(27),"@")
```

Printing variable values:

```
SET counter = 0  
REPEAT  
    SET counter = counter + 1  
    PRINTLF("This is the line",counter)  
UNTIL counter = 10
```

Enlarging the line spacing successively (n/ 180 inch by means of ESC 3 (n)):

```
SET N = 0  
REPEAT  
    SET N = N + 1  
    PRINT(char(27),"3",char(N))  
    PRINT(" Line spacing", N,"/180 inch")  
UNTIL N = 20
```

Printing a blank line:

```
PRINTLF()
```

Reaction to incorrect parameters or incorrect syntax

Normally incorrect parameters n , $n1$, etc. are automatically replaced by the respective default value (for example, if the specified value range is exceeded). Commands with parameters which are within the specified value range, but infringe on the set conditions, are ignored (for example, if horizontal absolute positioning is attempted outside the possible print area).

Exceptions to these rules are specified separately with the corresponding command description, if necessary.



An exact description of the printable areas and the definition of horizontal and vertical positions is contained in the section “Notes for document processing” in the chapter “Additional commands”.

Controlling the configuration of the printer

The status of the printer can be controlled from a program irrespective of the data to be printed via the following control commands:

Command	Function
ESC @	Initializing the printer ☺
ESC <	Selecting unidirectional printing for one line
ESC U (n)	Unidirectional printing mode on/ off one line ☺
ESC >	Setting the 8th bit of incoming data (MSB = 1)
ESC =	Deleting the 8th bit of incoming data (MSB = 0)
ESC #	Terminating control of the 8th bit (= delete MSB specification)
DC3	Switching printer off logically (Offline)
DC1	Switching printer on logically (Online)
ESC EM (n)	Setting the automatic single sheet feeder mode on/off

i On some computers the MSB value (Most Significant Bit) is always constant 1. In practice that would mean that in the character table only characters from the range of 80h to FFh could be addressed and then only italic or graphics characters or characters defined by the user could be printed.

The 8th bit can be deleted using the command **ESC =**. Therefore, characters from the basic character table (range from 20h to 7Fh) can also be printed.

On the other hand, for computers which can only transfer 7-bit data (MSB value always constant 0), the 8th bit can be set to 1 by **ESC >**. Then it is also possible to address italic or graphics characters, or characters defined by the user.

Initializing the printer

ESC	@	ASCII character
27	64	Decimal
1B	40	Hexadecimal

Function:

Via **ESC @** the printer can be reset by the program to certain operating conditions (initializing of software). **ESC @** resets the printer to the default values and deletes all the print data of the current line out of the print buffer, which were transmitted prior to the command.

The following actions will be executed:

- set line spacing to 6 lines per inch
- set the document format and the right and bottom margins to the default values (the current vertical position is defined as the new line 1)
- set the left margin to the value which has been set in the emulation menu (adjustable via the operating panel)
- set the character spacing to the value which has been set in the emulation menu (adjustable via the operating panel)
- set the print quality and type font to the value which has been set in the emulation menu (adjustable via the operating panel)
- delete vertical tabs and select channel 0
- switch off elongated, bold, double impact and italic print
- delete MSB specification
- set additional character spacing to 0
- delete superscript or subscript
- switch off underlining
- adjust printing flush left.



When initializing or defining printer parameters for certain applications, the following cases are to be differentiated:

- Parameters, which are specified by means of their default value
- Parameters, which are set by corresponding ESC sequences (document length, type font, character width, etc.)
- Parameters, which are reset to their default value by means of the command **ESC @**.

All default values of the document printer are listed in the appendix of this manual. If the printer is initialized via **ESC @** at any vertical position on a document, undesired results can occur during subsequent actions (current vertical position is new line 1). For this reason **ESC @** is not recommended for initializing parameters within a document.

Selecting unidirectional printing for one line

ESC	<	ASCII character
27	60	Decimal
1B	3C	Hexadecimal

Function:

Via **ESC <** the next printing line is printed from right to left. This command will be cancelled automatically by a carriage return (CR).

Switching the unidirectional printing mode on/ off

ESC	U	(n)	ASCII character
27	85	n	Decimal
1B	55	n	Hexadecimal

Function:

Normally printing is bidirectional (optimal printing path). Unidirectional printing (printing in only one direction) is sensible, for example, in order to ensure a precise positioning of the characters when printing a text or graphics, thus to produce a neat print format.

ESC U (n) activates or deactivates unidirectional printing, by which n serves as an on/ off switch:

n = 1 activates the mode (unidirectional on),

n = 0 deactivates the mode (unidirectional off).

Example:

After printing three lines, a change is to take place between bidirectional and unidirectional printing. Bidirectional printing begins.

```
BEGIN
  PRINT(char(27),"U",char(0))      <-- bidirectional on
  PRINTLF("bidirectional printing")
  PRINTLF("bidirectional printing")
  PRINTLF("bidirectional printing")
  PRINT(char(27),"U",char(1))      <-- bidirectional off
  PRINTLF()
  PRINTLF("unidirectional printing")
  PRINTLF("unidirectional printing")
  PRINTLF("unidirectional printing")
END
```

Result:

```
bidirectional printing
bidirectional printing
bidirectional printing

unidirectional printing
unidirectional printing
unidirectional printing
```

Setting the MSB to 1

ESC	>	ASCII character
27	62	Decimal
1B	3E	Hexadecimal

Function:

ESC > sets the most significant bit (MSB) of all incoming data to 1. Thus it is possible to print italic or graphics characters or characters defined by the user for programs on computers, which only transfer 7-bit data (access to character table range from hex 80 to hex FF).



The MSB setting via **ESC >** is deleted by the following ESC sequences:

- **ESC @** (Initializing the printer)
- **ESC =** (Deleting the most significant bit)
- **ESC #** (Deleting the MSB specification).

Setting the MSB to 0.

ESC	=	ASCII character
27	61	Decimal
1B	3D	Hexadecimal

Function:

ESC = sets the most significant bit (MSB) of all incoming data to 0 (zero). Thus it is possible to print characters of the standard code table even for programs on computers which only transfer 7- bit data.

- i** The MSB setting via **ESC =** is deleted by the following ESC sequences:
- **ESC @** (Initializing the printer)
 - **ESC >** (Setting the most significant bit)
 - **ESC #** (Deleting the MSB specification).

Deleting the MSB specification

ESC	#	ASCII character
27	35	Decimal
1B	23	Hexadecimal

Function:

ESC # cancels the MSB specification (deleting or setting the most significant bit) resulting from **ESC =** or **ESC >**.



An MSB specification resulting from **ESC =** or **ESC >** is also cancelled, when the printer is initialized with software (see **ESC @**).

Printer offline

DC3	ASCII character
19	Decimal
13	Hexadecimal

Function:

DC3 (device control 3) switches the printer offline (printer inactive) until a **DC1** code (printer online) is received.

In no way can the printer be reactivated via the STOP key.

Printer online

DC1	ASCII character
17	Decimal
11	Hexadecimal

Function:

DC1 (device control 1) switches the printer back online after it has previously been switched offline by a **DC3** code.

If the printer was switched off via the STOP key, it cannot be switched online again using this command.

Automatic single sheet feeder on/off

ASC II	Decimal	Hexadecimal	Function
0	48	30	Switches single sheet feeder off
1	49	31	Selects feeder compartment 1 (only if 2 feeder compartments are available)
2	50	32	Selects feeder compartment 2 (only if 2 feeder compartments are available)
4	52	34	Switches single sheet feeder on
R	82	52	Ejects one sheet without pulling in a new one.

Since the automatic single sheet feeder is not available for the document printer, all other parameters (n = R) are ignored except for one.



Instead of **ESC EM R** (= sheet ejection) use the **FF** (Form Feed) command to do without the **ESC EM** command altogether in an application.

Special character codes

In this chapter the following commands are described:

Command	Function
CR	Carriage Return ☺
BS	Backspace of one character ☺
DEL	Deleting a character
CAN	Canceling a line

Carriage return

CR	ASCII character
13	Decimal
0D	Hexadecimal

Function:

After **CR** (carriage return) the data contained in the buffer is printed and the print head is returned logically to the left edge.

If **CR**, according to the setting, for example, on the operating panel, is only interpreted as **CR**, the print head is returned on the same line. If necessary, an additional line feed must be achieved by subsequently pressing **LF** (line feed, see section “Line feed commands” in this chapter).

If **CR**, according to presetting, is interpreted as **CR + LF**, a line feed is added after execution of the carriage return.

Example:

A demonstration of the effect of **CR** commands depending on preset printer parameters.

```
BEGIN
  PRINT("Test line", char(13))
  PRINT("Test line", char(13))
  PRINT("Test line", char(13))
END
```

Result:

- **CR** without line feed

```
Test line
```

- **CR** with line feed

```
Test line
Test line
Test line
```

Backspace of one character

BS	ASCII character
8	Decimal
08	Hexadecimal

Function:

After each **BS** character (backspace) the print head is moved logically one character to the left. Thus characters can be printed one upon the other.

If this command is received immediately following graphics printing, the print head will return to the position in which it was before the start of graphics printing.

In the following cases the **BS** command is ignored:

- the print head is at the left edge
- the previous character is an **HT** character (horizontal tab as column limit)
- a command for an absolute or relative point positioning of the print head was received beforehand (**ESC \$ (n1) (n2)** or **ESC \ (n1) (n2)**)
- with **ESC a (n)** a text adjustment other than flush left was selected (i. e. centered, flush right or margin justification).

Example:

With **BS** the mathematical signs for 'corresponds to' and 'unequal' are to be produced.

```
BEGIN
  PRINTLF("corresponds to: ", "=", char(8), " ^")
  PRINTLF("unequal: ", "=", char(8), "/" )
END
```

Result:

```
corresponds to: ̂
unequal      : ̂
```

Deleting a character

DEL	ASCII character
127	Decimal
7F	Hexadecimal

Function:

DEL (Delete) deletes the previous text character in the buffer as long as it has not yet been printed. The control codes remain unchanged.

Cancelling a line

CAN	ASCII character
24	Decimal
18	Hexadecimal

Function:

CAN (Cancel) cancels in the printing buffer the whole text of one print line prior to this code, but not the control codes.

Line feed commands

The standard line spacing amounts to six lines per inch, i. e. the line spacing is 1/6 inch.

The line spacing can be changed using the following commands, whereby the smallest unit for the line spacing is 1/180 inch. The corresponding line feed is carried out depending on the set line spacing:

Command	Function	
LF	Line feed	☺
ESC J (n)	Carrying out an n/180 inch line feed	☺
ESC 0	Determining 1/8 inch line spacing	☺
ESC 2	Determining 1/6 inch line spacing	☺
ESC 3 (n)	Determining 1/180 inch line spacing	☺
ESC A (n)	Determining 1/60 inch line spacing	☺
ESC + (n)	Determining 1/360 inch line spacing	

Line feed

LF	ASCII character
10	Decimal
0A	Hexadecimal

Function:

On receipt of the command **LF** (line feed) the data contained in the buffer is printed and the paper transported one line further according to the current line spacing.



- If after **LF** the logical bottom edge of the sheet is exceeded (depending on the set document format), the document is ejected.
- If a bottom margin set using **ESC N (n)** is exceeded, the document is also ejected.
- The horizontal position is set back to the left margin (**CR**).

Carrying out an n/ 180 inch line feed

ESC	J	(n)	ASCII character
27	74	n	Decimal
1B	4A	n	Hexadecimal

Function:

ESC J (n) transports the paper n/ 180 inch on. A value between 0 and 255 must be given for n. This command produces an immediate line feed, but does not effect a carriage return (no CR with positioning of the print head at the beginning of the line).

ESC J (n) has no influence on the current line spacing, which results, for example, by means of **LF** (line feed).

Example:

A demonstration of the difference between a normal line feed and an n/ 180 inch feed.

```
BEGIN
  PRINTLF("This is the first line")
  PRINT("Second line")
  PRINT( char(27),"J", char(5))"           ← 5/180 inch
  PRINTLF("with the rest displaced by 5/180 inch")
  PRINTLF("Now it continues normally")
END
```

Result:

```
This is the first line
Second line with the rest displaced by 5/180 inch
Now it continues normally
```

Determining 1/8 inch line spacing

ESC	0	ASCII character
27	48	Decimal
1B	30	Hexadecimal

Function:

ESC 0 sets the line spacing to 1/8 inch for the subsequent line feed commands. The 0 is the ASCII character for the figure zero and not the ASCII code 0..



The line spacing set by **ESC 0** is cancelled, if

- the printer is initialized a new (**ESC @**)
- a different line spacing is set by means of **ESC 2**, **ESC 3 (n)** or **ESC A (n)**.

Example:

A demonstration of the difference between the standard line feed (1/6 inch) and the 1/8 inch line spacing. The printer begins with the standard line feed.

```
BEGIN
  PRINTLF("This is the first print line")
  PRINTLF("This is the second print line")
  PRINTLF()
  PRINT(char(27),"0")           <-- 1/8 inch
  PRINTLF("This is the first print line")
  PRINTLF("This is the second print line")
END
```

Result:

```
This is the first print line
This is the second print line

This is the first print line
This is the second print line
```

Determining 1/6 inch line spacing

ESC	2	ASCII character
27	50	Decimal
1B	32	Hexadecimal

Function:

ESC 2 sets the line spacing to 1/6 inch for the subsequent line feed commands. This value is the effective default value when the printer is switched on.

The 2 is the ASCII character for the figure two and not the ASCII code 2.

Example:

see **ESC 0**.

Determining n/180 inch line spacing

ESC	3	(n)	ASCII character
27	51	n	Decimal
1B	33	n	Hexadecimal

Function:

ESC 3 (n) sets the line spacing to n/ 180 inch for the subsequent line feed commands. A value between 0 and 255 inclusive must be given for n.

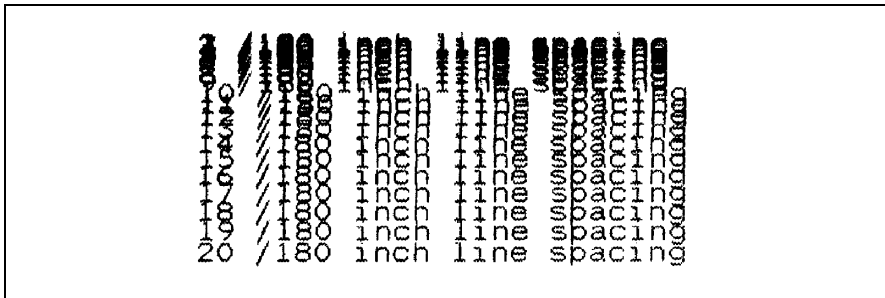
The 3 is the ASCII character for the figure three and not the ASCII code 3.

Example:

A demonstration of the printout for n = 1 to 20 with a measuring unit of n/ 180 inch line spacing.

```
BEGIN
  SET N = 0
  REPEAT
    SET N = N + 1
    PRINT( char(27),"3", char(N))
    PRINTLF( N,"/180 inch line spacing")
  UNTIL N = 20
END
```

Result:



Determining n/60 inch line spacing

ESC	A	(n)	ASCII character
27	65	n	Decimal
1B	41	n	Hexadecimal

Function:

ESC A (n) sets the line spacing to n/ 60 inch for the subsequent line feed commands. A value between 0 and 127 inclusive must be given for n (0 = no feed).

Example:

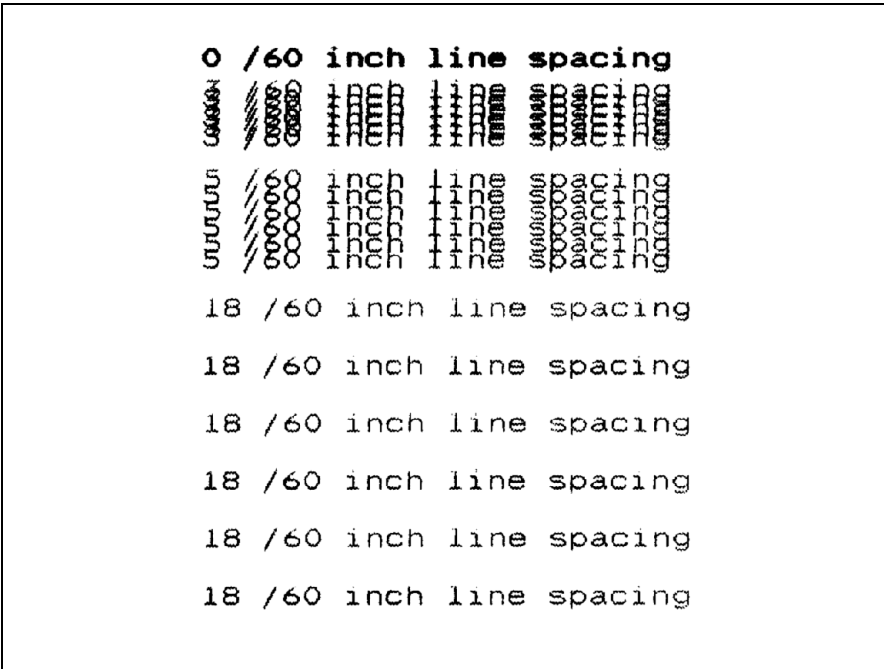
A demonstration of the printout using four n- values (0, 3, 5, 18) with a measuring unit of n/ 60 inch line spacing. 6 lines are printed for each n.

```

BEGIN
  SET loop = 0
  REPEAT
    SET loop = loop + 1
    SET N = 0
      N = 3
      N = 5
      N = 18
    CASE OF loop
    PRINT( char(27),"A", char(N)) <-- N = spacing
    SET line = 0
    REPEAT
      SET line = line + 1
      PRINTLF( N,"/60 inch line spacing")
    UNTIL line = 6
  UNTIL loop = 4
  PRINT( char(27),"@") <-Initializing the printer
  PRINTLF()
END

```

Result:



Determining n/360 inch line spacing

ESC	+	(n)	ASCII character
27	43	n	Decimal
1B	2B	n	Hexadecimal

Function:

ESC + (n) sets the line spacing to n/ 360 inch for the subsequent line feed commands (**LF**). A value between 0 and 255 inclusive must be given for n.

i As the document printer can only execute line feeds in a matrix of min. 1/180 inch, an uneven value for n (1, 3, 5, ...) leads to a rounding-off error of 1/360 inch.

Sheet ejection commands

The length of a document can be set directly or indirectly and the document ejected using the following commands:

Command	Function
FF	Sheet ejection
ESC C (n)	Determining the document length in lines
ESC C NUL (n)	Determining the document length in inches



Using **ESC C (n)** or **ESC C NUL (n)** the document length depending on the size of the document to be processed is set for the document.

On the basis of the document length thus set, the bottom margin (see **ESC N (n)**) can be set and the actual area to be printed on a document can be determined.

Sheet ejection

FF	ASCII character
12	Decimal
0C	Hexadecimal

Function:

After **FF** all the data still contained in the printing buffer is printed and subsequently the current document ejected.

After the ejection the current logical position of the print line (distance between the upper edge of the document and the base line of the print line) is identical to the insertion position set via the operating panel (value between 10/ 60 and 80/ 60 inch) if print data is transmitted without a previous insertion command. However, a document will not be requested until print jobs are available!

The insertion position can be set in the document printer menu by selecting the menu item TOF- POS (see the Operating Manual). The default value is 3/ 6 inch.Manual



If a further FF or a series of FFs immediately follow an FF, these will not be executed.

Determining the document length at n lines

ESC	C	(n)	ASCII character
27	67	n	Decimal
1B	43	n	Hexadecimal

Function:

ESC C (n) sets the document length at n lines in the selected line spacing. A value between 1 and 127 must be given for n. The actual physical document length is then determined by the respective current line spacing.

It should be noted that the respective document length (n lines * line spacing) must not exceed the length of the document.

The current line, in which the print head is located on receipt of the command, is fixed as the starting position of the document. A bottom margin set by means of **ESC N (n)** is cancelled (see the corresponding command description in the “Vertical print control” section).

i If the print head is positioned beyond the edge of the paper (for example, for a document length of 12 inches), the printer issues an error message (PAPER LENGTH). If a bottom margin is set logically on the paper via **ESC N (n)** (for example, at 9 inches) and this margin is exceeded, a form feed (FF) is executed.

Determining the document length at n inches

ESC	C	NUL	(n)	ASCII character
27	67	0	n	Decimal
1B	43	00	n	Hexadecimal

Function:

ESC C NUL (n) sets the document length at n inches (absolute document length independent of the line spacing). The value of n must lie between 1 (inch) and 50 (inches) inclusive.

The value n (inches) must be selected so that the length of the paper format is not exceeded. If the format is exceeded by a corresponding n, the printer automatically sets the maximum permitted format height as the current document length.

The current line, in which the print head is located on receipt of the command, is fixed as the starting position of the document. The bottom margin, possibly determined by **ESC N (n)**, is cancelled by **ESC C NUL (n)**.

i If the print head is positioned beyond the edge of the paper (for example, for a document length of 12 inches), the printer issues an error message (PAPER LENGTH). If a bottom margin is set logically on the paper via **ESC N (n)** (for example, at 9 inches) and this margin is exceeded, a form feed (FF) is executed.

Vertical print control

This section describes the commands for setting vertically arranged document positions (end of document and vertical tabs). An automatic end of document and feeding on certain lines are thus possible without the corresponding printing of blank lines.

The data of vertical tabs is allocated to channels, which are numbered from 0 to 7.

Command	Function
ESC N (n)	Setting the bottom margin
ESC O	Deleting the bottom margin
ESC B ... NUL	Determining/ deleting vertical tabs
ESC b (c) ... NUL	Determining/ deleting vertical tabs in channels
ESC / (c)	Selecting a vertical tab channels
VT	Vertical tabulation
ESC EM n	Paper control



A difference must be made between the vertical leading edges 'upper leading edge' and 'lower leading edge'. The vertical leading edges are defined in the chapter "Additional commands".

Setting vertical tabs is possible in two ways:

- up to 16 fixed tabs (**ESC B**)
- up to 8 tab groups (channels 0 to 7) with up to 16 tabs respectively (**ESC b**). In this case it is possible to switch over to a certain tab group depending on the application before the printing of a document (**ESC /**) and thereby the structure of different types of document can be controlled flexibly.

If tabs already set are to be reset, the old tab values for the corresponding channel must be deleted beforehand.

When setting vertical tabs, the appropriate absolute line position is calculated on the basis of the currently set line spacing. Even if the line spacing is altered at intervals, the line position of a tab remains unchanged. If necessary, when changing the line spacing, the old tab values must be deleted and set anew.

If no vertical tabs are defined, a tabulation command in a vertical direction is carried out as a line feed.

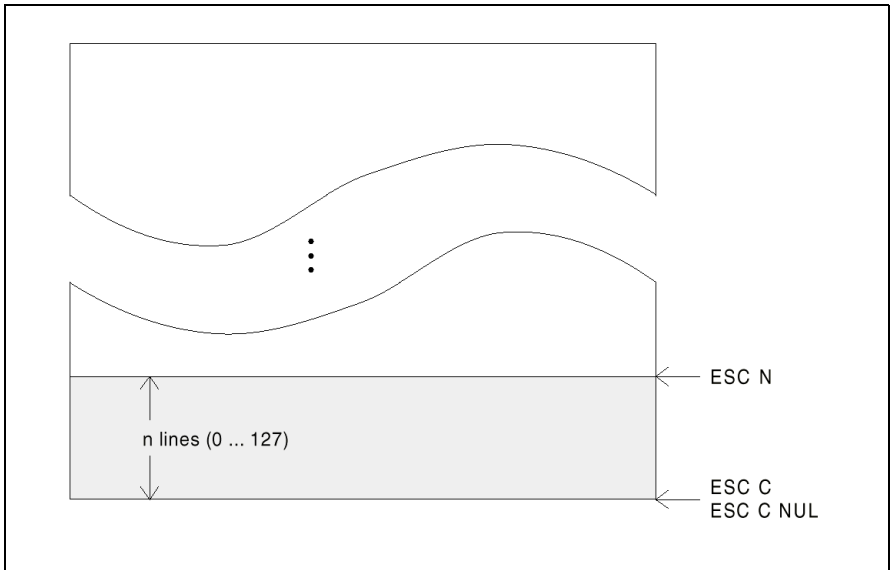
Setting the bottom margin

ESC	N	(n)	ASCII character
27	78	n	Decimal
1B	4E	n	Hexadecimal

Function:

ESC N (n) sets a bottom margin of n lines in the currently valid line spacing. The standard document length (presetting of the printer) or the document length set by **ESC C** (document length in lines) or by **ESC C NUL** (document length in inches) serves as the basis.

A value between 0 and 127 can be selected for n. The margin resulting from this must be smaller than the document length.



When the bottom margin is reached, a document ejection is automatically started.



- Subsequent alterations to the line spacing have no influence on the set margin area. If necessary, after a change in the line spacing the bottom margin setting must be deleted (ESC O) and then reset using ESC N.
- A set bottom margin is automatically cancelled, when the document length is altered using ESC C or ESC C NUL.

Deleting the bottom margin

ESC	O	ASCII character
27	79	Decimal
1B	4F	Hexadecimal

Function:

A bottom margin determined by **ESC N** or by the setting of the printer is deleted using **ESC O** .

Determining / deleting vertical tabs (channel 0)

ESC	B	(n1)	(n2)	...	NUL	ASCII character
27	66	n1	n2	...	0	Decimal
1B	42	n1	n2	...	00	Hexadecimal

Function:

- Setting tabs
Using **ESC B ... NUL** up to 16 vertical tabs can be determined in the relevant line spacing. Subsequent alterations in the line spacing do not affect this.

The tab values are entered as n1, n2 (number of lines), etc. from 1 up to and including 255 in ascending order. The sign **NUL** marks the end of the command.

- Deleting tabs
Via **ESC B NUL** the set tabs are deleted (**NUL** characters directly after **ESC B**).

- Using **ESC B ... NUL** the tabs are set in channel 0.
- If more than one set of tabs is to be defined, this must occur via **ESC b** (small b).
- A vertical tab jump occurs via the command **VT** (for ASCII decimal 11, hex 0B).

i

Determining / deleting vertical tabs for any channel

ESC	b	(c)	(n1)	...	NUL	ASCII character
27	98	c	n1	...	0	Decimal
1B	62	c	n1	...	00	Hexadecimal

Function:

- Setting tabs

ESC b (c) ... NUL has (in principle) the same function as **ESC B ... NUL**. By means of the variable *c* (a number between 0 and 7) a certain channel for vertical tabs can be selected additionally. Thus it is possible to define eight different tab groups, each with up to 16 vertical tabs.

The change between the tab channels occurs via the command **ESC / (c)**, whereby *c* identifies the corresponding channel number.

- Deleting the tabs for one channel

Via **ESC b (c) NUL** the tabs set in channel *c* (0 to 7) are deleted (NUL characters directly after **ESC b (c)**).



- If vertical tabs were set using **ESC B ... NUL**, channel 0 is occupied.
- Before tab values for a channel can be altered, these values must be previously deleted in the appropriate channel (for example, 'Deleting tabs in channel 0' using **ESC b 0 NUL** or **ESC B NUL**).

Selecting a vertical tab channel

ESC	/	(c)	ASCII character
27	47	c	Decimal
1B	2F	c	Hexadecimal

Function:

Via **ESC / (c)** a vertical tab channel *c* can be selected. The values 0 to 7 (= channel 0 to channel 7) are permitted for *c*.

For all subsequently entered **VT** commands (Vertical tabulation) the paper feed will then be controlled by the valid tabs in the current channel.

Vertical tabulation

VT	ASCII character
11	Decimal
0B	Hexadecimal

Function:

After **VT** all the data contained in the buffer is printed and the paper transported to the next tab in the current channel.

- i** – A channel can be selected via **ESC / (channel number)**.
- If no channel has been selected, the vertical tabs are accepted in channel 0.
- If no vertical tabs are set in the standard channel 0 nor in a selected channel 1 to 7, the paper is only transported one line on after VT (Line feed).

Paper control

ESC	EM	n	ASCII character
27	25	n	Decimal
1B	19	n	Hexadecimal

Parameter:

n=0 Deactivates the mode

n=1 Selects the feeder compartment 1

n=2 Selects the feeder compartment 1

n=4 Selects the feeder compartment 1

n=R Ejection



This command is only to be used if a single sheet feeder is installed. If the feeder is activated and no document has been fed by the operator, a document will be fed from the paper supply automatically when a print or line feed command is received.

Horizontal print control

This section describes the commands for setting horizontally arranged document positions (left or right margin and horizontal tabs). The following functions are possible:

- automatic end of line, i. e. automatic carriage return with line feed when a certain column position is reached
- feeding at certain column positions without the corresponding printing of blank spaces
- feeding to any (dot) positions of a line.

Command	Function	
ESC I (n)	Determining the left margin	☺
ESC Q (n)	Determining the right margin	☺
ESC a (n)	Determining the text adjustment	
ESC D (n1) (n2) ... NUL	Determining/ deleting horizontal tabs	
HT	Horizontal tabulation	
ESC \$ (n1) (n2)	Horizontal positioning (absolute)	☺
ESC \ (n1) (n2)	Horizontal positioning (relative)	☺
ESC SP (n)	Determining the character spacing	☺

When positioning the print head horizontally, a distinction must be made between the horizontal leading edge on the left and on the right. For example, with horizontal leading edge on the left, print position 0 can be the same as the left edge of the document or, after ESC I (n), displaced to the right by the value n. Dependences during horizontal print positioning are described in more detail in the “Additional commands” chapter.

When setting the left and right margins or the horizontal tabs the appropriate absolute column position is calculated on the basis of the currently set character size (10, 12, 15 cpi, elongated or condensed print). Even if the character size is altered at intervals, the absolute column position remains unchanged. If necessary, when changing the character size the old margin or tab values must be deleted and reset.

The length of the lines depends on the distance between the left (**ESC I**) and the right (**ESC Q**) margins. The adjustment of the text can be selected flush left, flush

right, centered or with margin justification (**ESC a**).

Feeding to a certain position on a line is specified in dots and calculated either starting from the left margin (**ESC \$**, 1 dot = 1/60 inch) or starting from the current print position (**ESC **, 1 dot = 1/180 inch or 1/120 inch).

Setting the left margin

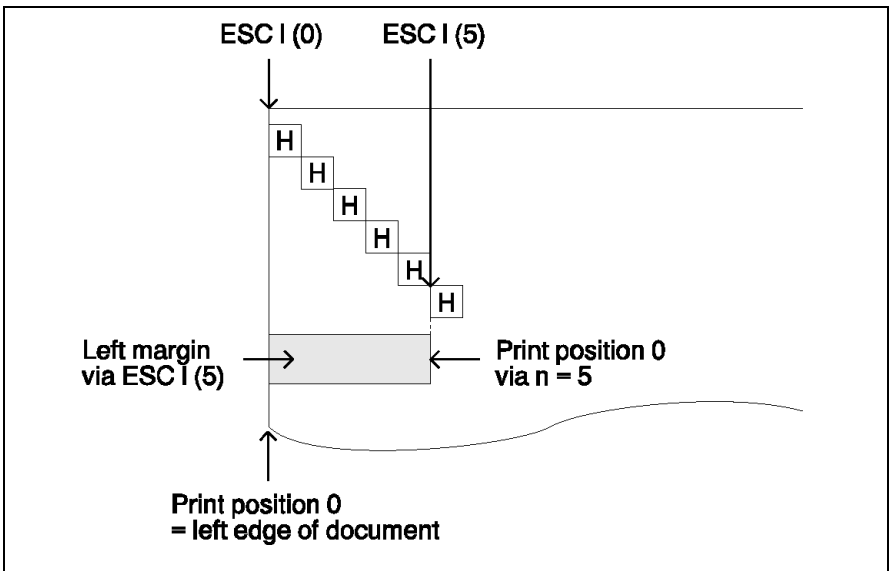
ESC	I	(n)	ASCII character
27	108	n	Decimal
1B	6C	n	Hexadecimal

Function:

Using **ESC I (n)** the horizontal 'print position 0' can be influenced, that is to say, a left margin can be set. The left margin (absolute distance from the left edge of the document) is determined by means of the value of n and the currently valid character width. A value between 0 and 160 can be selected for n. The margin resulting from this must not, however, be wider than 8 inches. If the left margin width is defined as greater than 8 inches, the command is ignored.

n = 0: print position 0 = left edge of document

n > 0: print position 0 = left edge of document + n





- The absolute margin position is dependent on the set character size (10, 12 or 15 cpi) and the print mode (condensed, elongated, normal). With proportional spacing the left margin is determined according to the character size 10 cpi. Subsequent alterations to the character size have no influence on the set margin.
- The distance between the left and right margins must be at least 10 cpi.
- **ESC I (n)** should be entered at the beginning of a print line as **ESC I (n)** deletes all the previously entered characters and tabs in the same print line.

Example:

First of all, the left document margin will be set using **ESC I (n)** for several values of n. Subsequently, the effect of the current character size on the left margin will be demonstrated.

```
BEGIN
  SET N = 6
  REPEAT
    SET N = N + 1
    PRINT(char(27),"1",char(N))  <-- Setting left margin
    PRINTLF("Left margin",N - 1,"columns")
  UNTIL N = 10
  PRINTLF()

                                     12 cpi character
  PRINT(char(27),"M")                <-- (ESC M)
  PRINT(char(27),"1",char(10))       <-- Setting left margin
  PRINTLF("Left margin 9 columns (12 cpi)")

  PRINT(char(27),"W",char(1))        <-- Switching on elongated
  PRINTLF("Left margin unchanged")    print(ESC SO)
  PRINT(char(27),"1",char(10))       <-- Setting left margin
  PRINTLF("margin 9 columns (elongated)")

  PRINT(char(27),"1",char(160))      <-- Left margin
  PRINTLF("margin ignored")           > 8 inch

  PRINTLF("not printed",char(27),"1",char(10),"printed")
END
```


Result (reduced in size):

```
Left margin 6 columns
Left margin 7 columns
  Left margin 8 columns
    Left margin 9 columns
      Left margin 9 columns (12 pitch)

Left margin unchanged
margin 9 columns (wide)
margin ignored
printed
```

Result (original size):

```
Left margin 6 columns
Left margin 7 columns
  Left margin 8 columns
    Left margin 9 columns
      Left margin 9 columns (12 pitch)

Left margin unchan
margin 9 colu
margin ignore
printed
```

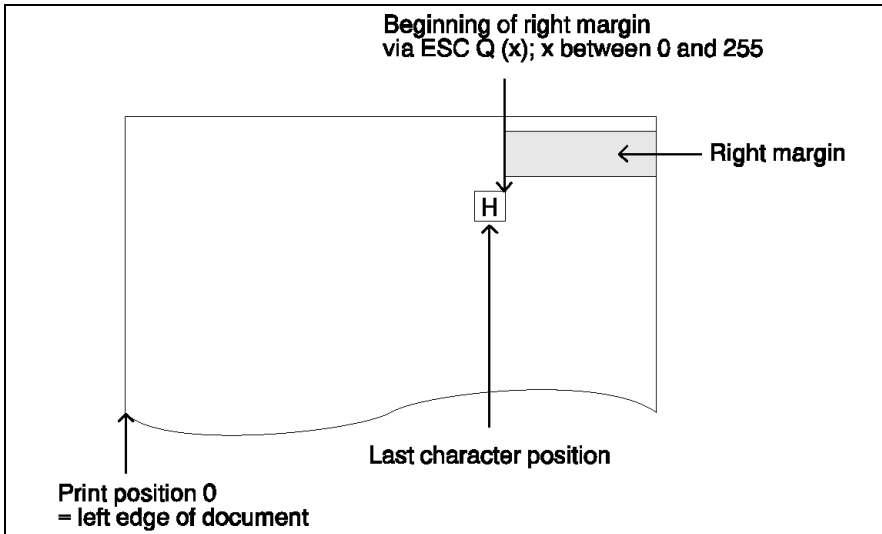
Setting the right margin

ESC	Q	(n)	ASCII character
27	81	n	Decimal
1B	51	n	Hexadecimal

Function:

ESC Q (n) influences the last horizontal print position, that is to say, a right margin can be set. The right margin is determined by means of the value of *n* and the current valid character width. A value between 0 and 255 can be selected for *n*.

The *n*th column will then not be printed.



If a text line exceeds the right margin, a carriage return with a line feed is automatically executed (even within a word). So many characters are printed in one line until the space between the left and right margins is used up. Printing is then continued on a new print line.

i

- The absolute margin position is dependent on the set character size (10, 12 or 15 cpi) and the print mode (condensed, elongated, normal). With proportional spacing, the right margin is determined according to the character size 10 cpi. Subsequent alterations to the character size have no influence on the set margin.
- The distance between the left and right margins must be at least two 2/10" (two characters with 10 cpi).
- **ESC Q (n)** should be entered at the beginning of a print line, as **ESC Q (n)** deletes all the previously entered characters and tabs in the same print line.

Example:

A demonstration of what effect a right margin has on the carriage return and line feed. (For the influence of the current character size on the right margin compare with control command for "Setting the left margin").

```
BEGIN
  SET N = 30
  REPEAT
    SET N = N + 4
    PRINT(char(27),"Q",char(N))      <-- Setting the right
    PRINT("Line length equal to the distance") margin
    PRINTLF(" between left and right margins")
  UNTIL N = 42
END
```

Result:

```
Line length equal to the distance
between left and right margins
Line length equal to the distance betw
een left and right margins
Line length equal to the distance between
left and right margins
```

Setting the text alignment

ESC	a	(n)	ASCII character
27	97	n	Decimal
1B	61	n	Hexadecimal

Function:

ESC a (n) sets the following text alignments depending on n (0 ... 3):

- flush left : n = 0 (default value)
- centered : n = 1
- flush right : n = 2
- margin justification : n = 3

The adjustment takes place after the output of the following control commands:

- **CR** (Carriage return, is output implicitly, for example, by the print command PRINTLF)
- **LF** (Line feed, is output implicitly, for example, by the print command PRINT LF)
- **VT** (Vertical tabulation)
- **FF** (Form feed)
- After an additional command (**ESC [...**)

With margin justification the text is aligned flush left and flush right. Thereby the word spacing and the character spacing are increased, if necessary. The division of a text into print lines takes place automatically. Therefore **LF** or **CR** commands, for example, via the print command PRINTLF, should only be used within a margin justification text in order to set a paragraph in the text.



- After switching on or initializing the printer (**ESC @**) the text alignment is flush left ($n = 0$).
- In most programming languages there are print commands, which, after the output of the printed text, automatically carry out the **CR** or **LF** command (for example, PRINTLF).
- The control commands **HT** (Horizontal tabulation) and **BS** (Backspace) are without effect with centered and flush right text alignment or with margin justification.
- **ESC a (n)** should be entered at the beginning of a print line, as **ESC a (n)** deletes all the previously entered characters in the same print line.

Setting / deleting horizontal tabs

ESC	D	(n1)	(n2)	...	NUL	ASCII character
27	68	n1	n2	...	0	Decimal
1B	44	n1	n2	...	00	Hexadecimal

Function:

- Setting tabs
Using **ESC D ... NUL** up to 32 column positions in the current character width can be set as horizontal tabs.

The tab values are specified as n1, n2, etc. between 1 and 137 inclusive in ascending order. Tab positions, which exceed the right margin, are ignored. The sign NUL marks the end of the command.

- Using **ESC D NUL** the set tabs are deleted (NUL sign directly after **ESC D**).



- A horizontal tab jump takes place via the command **HT** (for ASCII decimal 9 and hex 09).
- The absolute tab position is dependent on the set character size (10, 12 or 15 cpi) and the print mode (condensed, elongated, normal). With proportional spacing the tab positions are set according to the character size 10 cpi. Subsequent alterations to the character size do not affect the absolute tab positions.
- With condensed print the spacing of the tabs amounts to 60 % of the character width, with elongated print double the normal character spacing.
- After switching on the printer or after initializing (**ESC @**) the tabs are set at a spacing of eight 10-cpi characters.

Horizontal tabulation

HT	ASCII character
9	Decimal
09	Hexadecimal

Function:

Using **HT** the print head is set to the next tab position.

After positioning on the last (right) tab position the **HT** command has no effect. This also applies if all the tab positions were deleted using **ESC D NUL**.



- After switching on the printer or after initializing (**ESC @**) the tabs are set at a spacing of eight 10-cpi characters.
- The tab positions are set using the command **ESC D** and deleted using **ESC D NUL**.
- With centered and flush right text adjustment or with margin justification (**ESC a (n)**) the **HT** command is ignored.
- Various programs and computers convert the **HT** command into corresponding blank spaces instead of passing the command directly to the document printer.

Horizontal positioning (absolute)

ESC	\$	(n)	(m)	ASCII character
27	36	n	m	Decimal
1B	24	n	m	Hexadecimal

Function:

By means of **ESC \$ (n) (m)** the print head is moved horizontally to a position which is calculated independently of the current character size from the values *n* and *m* relative to the previously set "logical left" margin (left margin of sheet set using **ESC I (n)**). The distance of the print head from the left sheet margin results from the following formula:

$$(m * 256 + n) / 60 \text{ inch}$$

A value between 0 and 255 for *n* and a value between 0 and 3 for *m* can be selected. ($m * 256 + n$) may not be more than 816.

i **ESC \$ (n) (m)** is ignored if the specified position exceeds the logical right margin set using **ESC Q (n)**.

Example:

The distance of the text from the left sheet edge is increased step- by- step.

```
BEGIN
  SET N = 60
  REPEAT
    SET N = N + 30
    PRINT(char(27), "$", char(N,0))
    PRINT("Distance from left sheet edge")
    PRINTLF(N/60,"inch")
  UNTIL N = 180
END
```


Result (reduced in size):

```
Distance from left sheet edge 1.5 inch
  Distance from left sheet edge 2 inch
    Distance from left sheet edge 2.5 inch
      Distance from left sheet edge 3 inch
```

Result (Original size):

```
Distance from left sheet e
  Distance from left sr
    Distance from l
      Distance f
```

Horizontal positioning (relative)

ESC	\	(n)	(m)	ASCII character
27	92	n	m	Decimal
1B	5C	n	m	Hexadecimal

Function:

Via **ESC \ (n) (m)** the print head is displaced horizontally to a position relative to the current print position. The position is calculated depending on the selected print quality (Draft or LQ) from the values n and m using the following formula:

$$(m * 256 + n) / 120 \text{ inch (Draft)}$$

$$(m * 256 + n) / 180 \text{ inch (LQ)}$$



ESC \ (n) (m) is ignored if the specified position exceeds the right margin set using **ESC Q (n)**.

Example:

At the beginning the Draft print quality is set.

```
BEGIN
  PRINT("Displacement ")
  PRINT(char(27), "\", char(180,0))
  PRINTLF("by 1.5 inches")
  PRINT(char(27), "x", char(1))           <-- LQ-mode
  PRINT("Displacement ")
  PRINT(char(27), "\", char(180,0))
  PRINTLF("by 1 inch")
END
```

Result:

```
Displacement           by 1.5 inches
Displacement           by 1 inch
```

Determining the character spacing

ESC	SP	(n)	ASCII character
27	32	n	Decimal
1B	20	n	Hexadecimal

Function:

Using **ESC SP (n)** the normal distance between two print characters can be increased. The additional character spacing is calculated depending on the selected print quality (Draft or LQ) from the value of n using the following formula:

$n / 120$ inch (Draft)

$n / 180$ inch (LQ)

n can accept values between 0 and 127.



After switching on or initializing the printer (**ESC @**) n has the value 0.

Example:

The character spacing is increased step- by- step.

```
BEGIN
  SET N = 1
  REPEAT
    SET N = N + 2
    PRINT(char(27)," ",char(N))
    PRINTLF("Spacing for n equal to ",N)
  UNTIL N = 9
END
```

Result:

```
Spacing for n equal to 3
Spacing for n equal to 5
Spacing for n equal to 7
Spacing for n equal to
```

Print quality and character size

This section describes the commands for setting the print quality and the character size.

Command	Function	
ESC x (n)	Switching over the print quality (Draft/ LQ)	☺
ESC k (n)	Selecting the LQ type font	☺
ESC p (n)	Switching proportional spacing on/ off	☺
ESC P	Selecting the character size10 cpi	☺
ESC M	Selecting the character size12 cpi	☺
ESC g	Selecting the character size15 cpi (mikro print)	☺



Notes on the print quality:

According to the application one of the two following print quality settings can be selected:

- Draft print quality
This print quality is especially suited for quick draft printing. The characters are printed with a (horizontal) density of 60 print dots per inch.
- LQ print quality (Letter Quality)
The LQ print quality is suited for printing the (corrected) final version of a document. The characters are printed with a (horizontal) density of 180 print dots per inch.
In comparison to the draft print quality the characters contain more print dots. From this on the one hand a neater print face results, on the other hand a lower print rate compared with draft printing. In LQ print quality the type fonts “Roman” and “Sans Serif” are available standardly for the optical arrangement of a document. Further type fonts can be used if the appropriate font is loaded.



Notes on the character size:

- After switching on or initializing the printer the characters are printed with the data set in the emulation menu.

In normal print all the characters of one character size have the same spacing (for example 1/10 inch with 10 cpi).

Width and height of character (example 'H' character):

font	10 cpi width/ height	12 cpi width/ height	15 cpi width/ height	proportion- al width/ height
LQ-Sans Serif	2.0/2.6 mm	1.7/2.6 mm	1.4/1.9 mm	1.9/2.6 mm
LQ-Roman	2.3/2.5 mm	2.0/2.5 mm	1.5/1.8 mm	2.1/2.5 mm
DQ	1.8/2.5 mm	1.6/2.5 mm	1.4/1.9 mm	

With proportional spacing the different widths of the individual characters are taken into consideration, for example, the character 'i' is narrower than the character 'w', i. e. the print width of the character 'i' in proportional spacing is smaller than that of the character 'w'. Irregular spaces between the individual characters of a word are thus removed. The character width in proportional spacing varies between 1.0 and 2.6 mm. The size of the characters is 10 cpi. The print quality is switched to LQ.

Switching print quality (Draft/ LQ)

ESC	x	(n)	ASCII character
27	120	n	Decimal
1B	78	n	Hexadecimal

Function:

- Switching to draft print quality
ESC x (0) switches from LQ to draft print quality. This results in a higher print rate and a lower print density (60 print dots per inch in a horizontal direction).
 - Switching to LQ print quality
ESC x (1) switches from draft to LQ print quality. This results in a lower print rate and a higher print density (180 print dots per inch in a horizontal direction).
- i**
- Switching from draft to LQ is also possible within a print line.
 - After switching to LQ print quality, printing takes place in the last print type selected using **ESC k (n)**.
 - After switching on or initializing (**ESC @**) the printer prints in the print quality which has been set in the emulation menu.
 - When switching on the proportional spacing, the print quality is automatically set to LQ.

Example:

The character spacing is increased step- by- step.

```
BEGIN
  PRINT(char(27), "x", char(0))
  PRINTLF("print quality Draft")
  PRINT(char(27), "x", char(1))
  PRINTLF("print quality LQ")
END
```

Result:

```
print quality Draft
print quality LQ
```

Selecting the LQ type font

ESC	k	(n)	ASCII character
27	107	n	Decimal
1B	6B	n	Hexadecimal

Using **ESC k (n)** the following type fonts in LQ print quality can be selected:

n = 0 LQ type font Roman

n = 1 LQ type font Sans Serif

The selection of the type font can take place in draft or in LQ mode. The selected type font is only actually printed in LQ print quality mode (switch with **ESC x (1)**).

The selection of further fonts not corresponding to the allocation of the IBM- 2 character set is via a separate command (see "Selection of type fonts/ character sets" in the "Additional commands" chapter)..

i The characters of the different type fonts are available in the character sizes 10 cpi, 12 cpi, 15 cpi and proportional.

Example:

```
BEGIN
  PRINTLF(char(27),"x",char(1)  <-- LQ-mode on
  PRINTLF(char(27),"k",char(0),
  "type font Roman")
  PRINTLF(char(27),"k",char(1),
  "type font Sans Serif")
END
```

Result:

```
type font Roman
type font Sans Serif
```

Switching proportional spacing on/off

ESC	p	(n)	ASCII character
27	112	n	Decimal
1B	70	n	Hexadecimal

Function:

- Switching on proportional spacing
ESC p (1) switches proportional spacing on. With proportional spacing the character layout is based on the character size 10 cpi. The character width of the individual characters is however different, for example, the width of the character 'i' is smaller than that of the character 'w'. In normal print all the characters have the same width, whereby irregular spaces arise between the individual characters of a word.
- Switching off proportional spacing
ESC p (0) switches proportional spacing off.



- After switching on or initializing (**ESC @**) the printer, proportional spacing is possible, if it has been set in the emulation menu.
- **ESC p (1)** switches automatically to LQ print quality.

Example:

```
BEGIN
  PRINT("This line is not printed with proportional ")
  PRINTLF("spacing")
  PRINT(char(27), "p", char(1))
  PRINTLF("This line is printed with proportional ")
  PRINTLF("spacing")
END
```

Result (reduced in size):


```
This line is not printed with proportional spacing
This line is printed with proportional spacing
```

Selecting the character size 10 cpi (Pica)

ESC	P	ASCII character
27	80	Decimal
1B	50	Hexadecimal

Function:

ESC P sets the character size to 10 cpi (10 characters per inch). This character size is also set after switching on or initializing the printer if it has been selected in the emulation menu.

-  – The character size 10 cpi can be combined with condensed and elongated print.
- The command **ESC P** is normally used to deactivate the 12 cpi or 15 cpi character size.

Example:

```
BEGIN
  PRINT(char(27),"P")
  PRINTLF("character size 10 cpi")
  PRINT(char(27),"M")
  PRINTLF("character size 12 cpi")
  PRINT(char(27),"g")
  PRINTLF("character size 15 cpi")
END
```

Result:

```
character width 10 cpi
character width 12 cpi
character width 15 cpi
```

Selecting the character size 12 cpi (Elite)

ESC	M	ASCII character
27	77	Decimal
1B	4D	Hexadecimal

Function:

ESC M sets the character size to 12 cpi (12 characters per inch). Set character sizes in 10 cpi or 15 cpi are cancelled.



- After switching on or initializing the printer, the character size is set to the value, which has been set in the emulation menu.
- The character size 12 cpi can be combined with condensed and elongated print.
- With proportional spacing the character size is set to 10 cpi.

Example:

```
BEGIN
PRINT(char(27),"P")
PRINTLF("character size 10 cpi")
PRINT(char(27),"M")
PRINTLF("character size 12 cpi")
PRINT(char(27),"g")
PRINTLF("character size 15 cpi")
END
```

Result:

```
character width 10 cpi
character width 12 cpi
character width 15 cpi
```

Selecting the character size 15 cpi

ESC	g	ASCII character
27	103	Decimal
1B	67	Hexadecimal

Function:

ESC g sets the character size to 15 cpi (15 characters per inch). Set character sizes in 10 cpi or 12 cpi are cancelled.



- After switching on or initializing the printer, the character size is set to the value, which has been set in the emulation menu.
- The character size 15 cpi can be combined with elongated print, however, not with condensed print.
- With proportional spacing the character size is set to 10 cpi.

Example:

```
BEGIN
PRINT(char(27),"P")
PRINTLF("character size 10 cpi")
PRINT(char(27),"M")
PRINTLF("character size 12 cpi")
PRINT(char(27),"g")
PRINTLF("character size 15 cpi")
END
```

Result:

```
character width 10 cpi
character width 12 cpi
character width 15 cpi
```

Print modes

The use of different print modes (e. g., bold print, elongated print, underlining) enables a document to be structured for optical effect. This section describes the commands for the selection of the print modes..

Command	Function	
SI	Switch on condensed print	☺
ESC SI	Switch on condensed print	☺
DC2	Switch off condensed print	☺
SO	Switch on elongated print for one line	
ESC SO	Switch on elongated print for one line	
DC4	Switch off elongated print for one line	
ESC W (n)	Switch elongated print on/ off	☺
ESC w (n)	Activate / deactivate double character height	☺
ESC E	Switch on bold print	☺
ESC F	Switch off bold print	☺
ESC G	Switch on double impact print	☺
ESC H	Switch off double impact print	☺
ESC - (n)	Switch underlining on/off	☺
ESC S (n)	Switch on superscript/subscript	☺
ESC T	Switch off superscript/subscript	☺
ESC ! (n)	Select combined print mode	☺



- By selecting condensed or elongated print the width of the characters is changed (condensed = 60% of the normal character width, elongated = 200% of the normal character width).
- Not all print modes and character sizes can be combined. Invalid combinations are pointed out in the description of the individual commands.
- Using **ESC ! (n)** it is possible to switch on or off all print modes (with the exception of superscript and subscript), the character sizes 10 cpi and 12 cpi, proportional spacing and italic print on or off with a single command.

Switching on condensed print

SI	ASCII character
15	Decimal
0F	Hexadecimal

Function:

SI switches condensed print on. The character size in condensed print is approximately 40% smaller than in normal print.

- i** – The command **SI** has the same effect as the command **ESC SI**.
- Condensed print is switched off again using **DC2**.
- Condensed and elongated print can be combined.
- 10 cpi and 12 cpi characters can be printed condensed. 15 cpi characters cannot be printed condensed.
- Condensed print can be set in the emulation menu.

Example:

```
BEGIN
  PRINTLF("standard print")
  PRINT(char(15))           <-- Condensed print on
  PRINTLF("condensed print")
  PRINT(char(18))           <-- Condensed print off
  PRINTLF("standard print")
END
```

Result:

```
standard print
condensed print
standard print
```


Switching on condensed print

ESC	SI	ASCII character
27	15	Decimal
1B	0F	Hexadecimal

Function:

ESC SI has the same effect as the command **SI**.

Switching off condensed print

DC2	ASCII character
18	Decimal
12	Hexadecimal

Function:

DC2 switches the condensed print off, which was set using **SI**, **ESC SI** or **ESC ! (n)** or in the emulation menu.

Example:

```
BEGIN
  PRINT( "normal " , char(15) , "condensed" )
  PRINTLF(char(18) , "normal" )
END
```

Result:


```
normal condensed normal
```

Switching on elongated print for one line

SO	ASCII character
14	Decimal
0E	Hexadecimal

Function:

SO switches on elongated print for the current print line. Before beginning the next print line elongated print is switched off again. In elongated print the width of the characters is doubled.

-  – The command **SO** has the same effect as the command **ESC SO**.
- Elongated print is switched off again using **DC4**.
- Elongated print can be combined with condensed print and all the character sizes (10, 12, 15 cpi).

Switching on elongated print for one line

ESC	SO	ASCII character
27	14	Decimal
1B	0E	Hexadecimal

Function:

ESC SO has the same effect as the command **SO**.

Switching off elongated print

DC4	ASCII character
20	Decimal
14	Hexadecimal

Function:

DC4 switches off the elongated print set using **SO** or **ESC SO** (within the current print line).



Elongated print switched on using **ESC W (n)** or **ESC ! (n)** is not switched off by **DC4**.

Switching elongated print on/off

ESC	W	(n)	ASCII character
27	87	n	Decimal
1B	57	n	Hexadecimal

Function:

- Switching on elongated print
ESC W (1) switches elongated print on. In elongated print the width of the characters is doubled.
- Switching off elongated print
ESC W (0) switches elongated print off.

i Elongated print can be combined with condensed print and all the character sizes (10, 12, 15 cpi).

Example:

```
BEGIN
PRINTLF("standard print")
PRINT(char(27),"W",char(1))      ← Elongated print on
PRINTLF("elongated print")
PRINT(char(27),"W",char(0))     ← Elongated print off
PRINTLF("standard print")
END
```

Result:

```
standard print
elongated print
standard print
```

Enable/Disable Double Character Height

ESC	w	(n)	ASCII character
27	119	n	Decimal
1B	77	n	Hexadecimal

Function:

All characters following this command are printed with double the normal height.

Parameters:

n = 0 deactivates the mode

n = 1 activates the mode

Switching on bold print

ESC	E	ASCII character
27	69	Decimal
1B	45	Hexadecimal

Function:

ESC E switches bold print on. With bold print each dot of a print character is printed twice. The second dot is printed slightly displaced to the right.



- Bold print is switched off again using **ESC F** or **ESC ! (n)**.
- Bold print and double impact print can be combined.
- Bold print can be used with draft and LQ print quality.
- The print rate is slower with bold print than with normal print.

Example:

```
BEGIN
  PRINTLF("standard print")
  PRINT(char(27),"E")                <-- Bold print on
  PRINTLF("bold print")              LQ print quality
  PRINT(char(27),"x",char(1))        <-- (ESC x (n))
  PRINTLF("bold print in LQ print quality")
  PRINT(char(27),"G")                <-- Double impact print on
  PRINT("bold print and double impact print") (ESC G)
  PRINTLF(" in LQ print quality")
END
```

Result (reduced in size):

```
standard print
bold print
bold print in LQ print quality
bold print and double impact print in LQ print quality
```


Switching off bold print

ESC	F	ASCII character
27	70	Decimal
1B	46	Hexadecimal

Function:

ESC F switches off the bold print set using **ESC E** or **ESC ! (n)**.

Example:

```
BEGIN
  PRINT("normal",char(27),"E"," bold")
  PRINTLF(char(27),"F"," normal")
END
```

Result:

```
normal bold normal
```

Switching on double impact print

ESC	G	ASCII character
27	71	Decimal
1B	47	Hexadecimal

Function:

ESC G switches double impact print on. With double impact print each line is printed twice, the second time slightly displaced horizontally.

- i** – Double impact print is switched off again using **ESC H** or **ESC ! (n)**.
- Double impact print and bold print can be combined.
- Double impact print can be used with draft and LQ print quality.

Example:

```
BEGIN
  PRINTLF("standard print")
  PRINT(char(27),"G")
  PRINTLF("double impact print on")
  PRINT(char(27),"x",char(1))
  PRINTLF("double impact print in LQ print quality")
  PRINT(char(27),"E")
  PRINT("bold print and double impact print")
  PRINTLF(" in LQ print quality")
END
```

Result (reduced in size):

```
standard print
double impact print
double impact print in LQ print quality
bold print and double impact print in LQ print quality
```

Switching off double impact print

ESC	H	ASCII character
27	72	Decimal
1B	48	Hexadecimal

Function:

ESC H switches off the double impact print set using **ESC G** or **ESC ! (n)**.

Example:

```
BEGIN
  PRINT("normal",char(27),"G"," double impact")
  PRINTLF(char(27),"H"," normal")
END
```

Result:

```
normal double impact normal
```

Switching underlining on/off

ESC	-	(n)	ASCII character
27	45	n	Decimal
1B	2D	n	Hexadecimal

Function:

- Switching on underlining
After setting **ESC - (1)** all subsequent print characters (even the spaces) are underlined continuously.
- Switching off underlining
ESC - (0) switches off the underlining of the print characters.

Example:

```
BEGIN
  PRINT("Highlighting",char(27),"-",char(1))
  PRINT(" with underlining")
  PRINT(char(27),"-",char(0))
  PRINTLF(" is possible.")
END
```

Result:

```
Highlighting with underlining is possible.
```

Switching on superscript/subscript

ESC	S	(n)	ASCII character
27	83	n	Decimal
1B	53	n	Hexadecimal

Function:

- Switching on superscript
After setting **ESC S (0)** all subsequent print characters are printed reduced to half the size and displaced upwards (for example, in mathematical or chemical formulas).
- Switching on subscript
After setting **ESC S (1)** all subsequent print characters are printed reduced to half the size and displaced downwards (for example, in mathematical or chemical formulas).

- i
- Superscript or subscript is switched off again using **ESC T**.
 - If superscript or subscript characters are underlined, the underlining appears in the normal position. The underlining must be switched off beforehand, if necessary (**ESC - (n)**).

Example:

```
BEGIN
PRINT("Water: H")
*** Subscript on (S)/off (T) ***
PRINT(char(27), "S", char(1), "2")
PRINTLF(char(27), "T", "O")
PRINT("Einstein: E = mc")
*** Superscript on (S)/off (T) ***
PRINT(char(27), "S", char(0), "2")
PRINTLF(char(27), "T")
END
```

Result:

```
Water: H2O
Einstein: E = MC2
```

Switching off superscript/subscript

ESC	T	ASCII character
27	84	Decimal
1B	54	Hexadecimal

Function:

ESC T switches off superscript or subscript of the print characters.

Selection of combined print mode

ESC	!	(n)	ASCII character
27	33	n	Decimal
1B	21	n	Hexadecimal

Function:

Using **ESC ! (n)** the following character sizes and print modes in any (valid) combination can be switched on or off (by specifying a value n between 0 and 255):

- 10 cpi character size (Pica)
 - 12 cpi character size (Elite)
 - Proportional spacing
 - Condensed and elongated print
 - Bold and double impact print
 - Italic print
 - Underlining
 - Switching on several print modes or character sizes
- The following list shows which values must be specified for n in order to switch on certain character sizes or print modes:

Print mode/character size	Value of n
10 cpi (standard)	0
12 cpi	1
Proportional spacing (10 cpi)	2
Condensed print	4
Bold print	8
Double impact print	16
Elongated print	32
Italic print	64
Underlining	128

- Combination of several print modes or character sizes
In order to combine several print modes or character sizes the values given in the list (above) must be added together.

Calculation examples:

Proportional spacing, bold print, underlining:

$$n = 2 + 8 + 128 = 138$$

12 cpi, condensed print, double impact print:

$$n = 1 + 4 + 16 = 21$$



- **ESC ! (0)** switches off all print mode combinations and sets the character size to 10 cpi.
- **ESC ! (n)** can be used in combination with the commands for switching the individual print modes or character sizes on and off.
- When switching on proportional spacing the character size is set to 10 cpi (Pica) and LQ print quality is switched on.

Example:

```
BEGIN
  PRINT(char(27),"!",char(0))
  PRINTLF("10 pitch normal")
  PRINT(char(27),"!",char(1))
  PRINTLF("12 pitch normal")
  PRINT(char(27),"!",char(2),"proportional")
  PRINT(char(27),"!",char(130))
  PRINTLF(" and underlined")
  PRINT(char(27),"!",char(0),"normal")
  PRINT(char(27),"!",char(64)," italic")
  PRINT(char(27),"!",char(72)," italic bold")
  PRINT(char(27),"!",char(192))
  PRINTLF(" italic underlined")
END
```

Result (reduced in size):

```
10 cpi normal
12 cpi normal
proportional and underlined
normal italic italic bold italic underlined
```

Non- executable commands

This section describes the commands which cannot be executed by the document printer because of specific requirements. Such commands are ignored, therefore they do not cause an error.

Command	Function
BEL	Signal tone
ESC s (n)	Switching half- rate printing on/ off
ESC r (n)	Selecting the print colour

Signal tone

BEL	ASCII character
7	Decimal
07	Hexadecimal

Function:

BEL normally activates the acoustic signal of a printer. The document printer has no bleeper.

Switching half- rate printing on/off

ESC	s	(n)	ASCII character
27	115	n	Decimal
1B	73	n	Hexadecimal

Function:

ESC s (1) normally switches to half- rate printing. **ESC s (0)** cancels this mode again. This command is not relevant for the document printer.

Selecting the print colour

ESC	r	(n)	ASCII character
27	114	n	Decimal
1B	72	n	Hexadecimal

Function:

With a suitable printer by means of **ESC r (n)** a print colour can be selected depending on the n value (for example, 0 = black, 1 = red, 2 = blue).

With the document printer “black” is always the standard colour.

Character set commands

With the help of the following control commands, it is possible to change between the different character sets of the printer. Furthermore, your own characters can be defined as dot patterns and stored in the memory of the printer.

Command	Function
ESC % (n)	Switching on/ off the character set defined by the user
ESC & (n) (n) (m)	Transferring the character definition
ESC 4	Switching on italic print ☺
ESC 5	Switching off italic print ☺
ESC 6	Switching on extended character set ☺
ESC 7	Switching off extended character set
ESC : NUL (n) NUL	Copying the character set into the RAM
ESC R (n)	Selecting the national character set
ESC t (n)	Selecting the character set

i By means of CSI sequences, further character sets with specially defined font qualities can be selected (see the additional command **CSI n # q** in the “Additional commands” chapter). Character fonts selected in this way are treated as normal LQ type fonts, that is to say, all standard commands (print quality, character size, types of print) also work on these character sets in the way described in the “Standard commands” chapter.

General notes on the command description can be found in the “Standard commands” chapter in the sections “Description components”, “Coding of decimal command parameters” and “Program examples”.

Character set selection

The document printer prints characters as dot patterns. The data for the dot patterns of the characters is stored in the ROM (Read Only Memory) of the printer. If the printer receives a character code from the computer, it prints the corresponding character according to the stored pattern.

Two areas are differentiated with the printable character codes:

- area with the basic characters or italic characters
- area with the italic characters or graphics and special characters.

To differentiate the character code areas the following labels are used in this chapter:

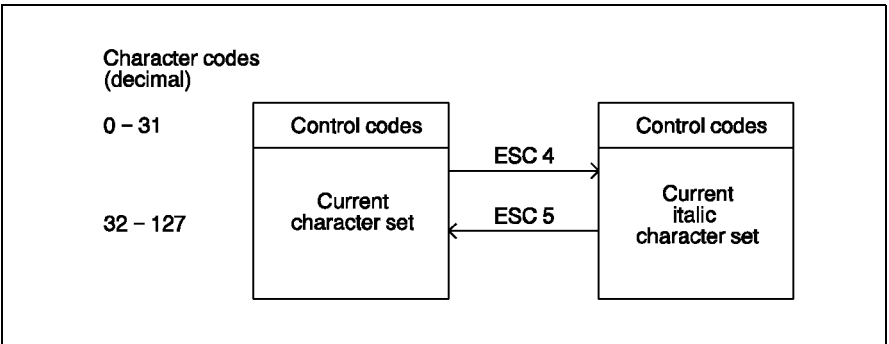
- 'lower control code table' for the code range from hex 00 to hex 1F (decimal 0 to 31)
- 'lower character table' for the code range from hex 20 to hex 7F (decimal 32 to 127)
- 'upper control code table' for the code range from hex 80 to hex 9F (decimal 128 to 159)
- 'upper character table' for the code range from hex A0 to hex FF (decimal 160 to 255)
- 'complete upper character table' for the code range from hex 80 to hex FF (decimal 128 to 255).

The following character set definitions result from this:

- The 'italic character set' contains basic characters in the lower character table and italic characters in the upper character table
- The 'graphics character set' contains basic characters in the lower character table and graphics characters in the upper character table
- The 'extended graphics set' contains a basic character set in the lower character table and graphics characters in the complete upper character table.

i After switching on the document printer, the following character sets are set:

- Extended graphics character set. This correspond to the settings using the maximum number of characters.
- Country version (set in the emulation menu).

Area with basic characters or italic characters

This area lies in the lower character table (hex 20 to hex 7F or decimal 32 to 127). It contains large and small letters, figures, punctuation marks and special characters in the print quality selected in each case (draft or LQ) or the LQ type font (Roman, Sans Serif). The characters in the lower character table can be printed by specifying the character code according to the following table.

Basic character set:

	0	1	2	3	4	5	6	7
0			0	@	P	'	p	
1		!	1	A	Q	a	q	
2		"	2	B	R	b	r	
3		#	3	C	S	c	s	
4		\$	4	D	T	d	t	
5		§	%	5	E	U	e	u
6		&	6	F	V	f	v	
7		'	7	G	W	g	w	
8		(	8	H	X	h	x	
9		)	9	I	Y	i	y	
A		*	:	J	Z	j	z	
B		+	;	K	[	k	{	
C		,	<	L	\	l	;	
D		-	=	M	]	m	}	
E		.	>	N	^	n	~	
F		/	?	O	_	o		

After entry of the control commands **ESC 4** ('Switching on italic printing') and **ESC ! (64)** ('Selection of combined print modes') all the basic character symbols of the currently selected print quality or LQ type font are printed in italics.



The lower control code table is occupied by control codes (hex 00 to 1F or decimal 0 to 31). It contains no printable characters. An exception is the character '§' (hex 15, decimal 21) by which the lower control code table is extended.

Country versions (national character sets)

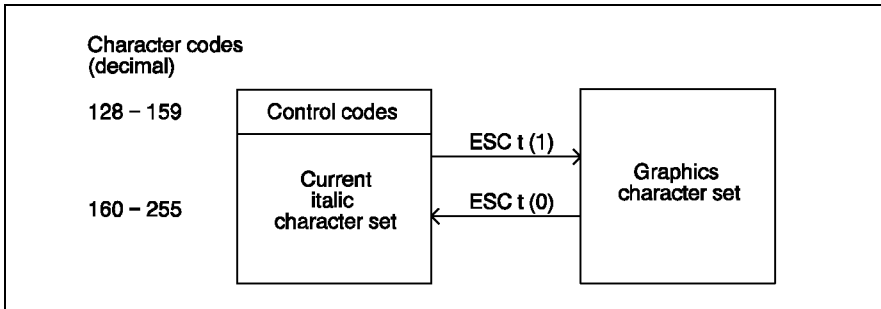
A total of twelve character codes of the basic character set (hex 23-24, 40, 5B-60 and 7B- 7E) can be occupied with national special characters using the command **ESC R (n)**. Thirteen country versions are available:

decimal		35	38	64	91	92	93	94	96	123	124	125	126
hexadecimal		23	24	40	5B	5C	5D	5E	60	7B	7C	7D	7E
n	country variants												
0	USA	#	\$	@	[	\	\]	^	`	{	|	}	~
1	France	#	\$	à	°	ç	§	^	`	é	ù	è	--
2	Germany	#	\$	š	À	Ö	Ü	^	`	ä	ö	ü	ß
3	Great Britain	£	\$	@	[	\	\]	^	`	{	|	}	~
4	Denmark 1	#	\$	@	Æ	Ø	Å	^	`	æ	ø	å	~
5	Sweden	#	¤	É	Å	Ö	Å	Ü	é	ä	ö	å	ü
6	Italy	#	\$	@	°	\	é	^	`	à	ò	è	ì
7	Spain 1	£	\$	@	í	Ñ	¿	^	`	ñ	í	~	~
8	Japan	#	\$	@	[	¥	]	^	`	{	|	}	~
9	Norway	#	¤	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü
10	Denmark 2	#	\$	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü
11	Spain 2	#	\$	á	í	Ñ	¿	é	`	í	ñ	ó	ú
12	Latin America	#	\$	á	í	Ñ	¿	é	ü	í	ñ	ó	ú

i

The country versions also apply for italic characters in the upper character table.

Area with italic characters or graphics and special characters



The italic character area for the italic character set lies in the upper character table. It contains all the basic characters in the currently selected print quality or LQ type font in italics.

For the graphics character set there are graphics characters in the upper character table. For the extended graphics character set there are special characters and graphics characters in the complete upper character table (special characters in the area of the upper control code table; hex 80 to 9F).

All the characters in the upper or complete upper character table can be printed by specifying the character code according to the following tables.



This function should not be used. Today it is good style to use the character set commands **ESC 4** (italics on) and **ESC 5** (italics off) to select italic printing.

Graphics character table

	8	9	A	B	C	D	E	F
0			á	⌘	⌘	⌘	⌘	⌘
1			í	⌘	⌘	⌘	⌘	⌘
2			ó	⌘	⌘	⌘	⌘	⌘
3			ú	|	⌘	⌘	⌘	⌘
4			ñ	⌘	-	⌘	⌘	⌘
5			Ñ	⌘	+	⌘	⌘	⌘
6			ä	⌘	⌘	⌘	⌘	⌘
7			ö	⌘	⌘	⌘	⌘	⌘
8			¿	⌘	⌘	⌘	⌘	⌘
9			⌘	⌘	⌘	⌘	⌘	⌘
A			⌘	⌘	⌘	⌘	⌘	⌘
B			½	⌘	⌘	■	ø	√
C			¼	⌘	⌘	■	∞	ⁿ
D			¡	⌘	=	■	ø	²
E			«	⌘	⌘	■	ε	■
F			»	⌘	⌘	■	∩	

Here the upper control code table (hex 80 to 9F) is not occupied by printable characters.

Extended graphics character table:

	8	9	A	B	C	D	E	F
0	Ç	É	á	☼	⊥	α	≡	
1	Û	æ	í	☼	⊥	⊥	β	±
2	é	Æ	ó	☼	⊥	⊥	Γ	≥
3	â	ô	ú	|	†	⊥	π	≤
4	ä	ö	ñ	†	-	⊥	Σ	∫
5	à	ò	ñ	†	†	⊥	σ	∫
6	ã	û	â	†	†	⊥	μ	÷
7	ç	ù	ø	†	†	†	τ	≈
8	ê	ÿ	¿	†	⊥	†	Φ	°
9	ë	Ö	¬	†	⊥	⊥	θ	·
A	è	Ü	¬	⊥	⊥	⊥	Ω	·
B	ï	ϕ	½	†	⊥	■	δ	√
C	î	£	¼	⊥	†	■	∞	n
D	ì	¥	¡	⊥	=	■	∅	²
E	Ë	ℙ	«	⊥	†	■	ε	■
F	À	f	»	†	⊥	■	∩	

The upper control code table is occupied by printable special characters. After the control command **ESC t (1)** has been entered, the extended graphics character set can be addressed in the complete upper character table.

Characters defined by the user

The pattern of the ground character in the used print qualities and fonts and the graphic signs are in the resident memory of the printer. After turn off the printer this memory is not lost.

In addition, the user can define his own characters. For this, an appropriate dot pattern must be developed, encrypted via a sequence of numbers and transferred to the memory of the printer by means of the control code **ESC &**. A character code between hex 00 and hex 7F (decimal 0 to 127) is assigned to a character defined by the user.

After changing with **ESC %** from the graphic signs in the resident memory to the user defined graphic signs, this signs can be used with the defined code.

Example:

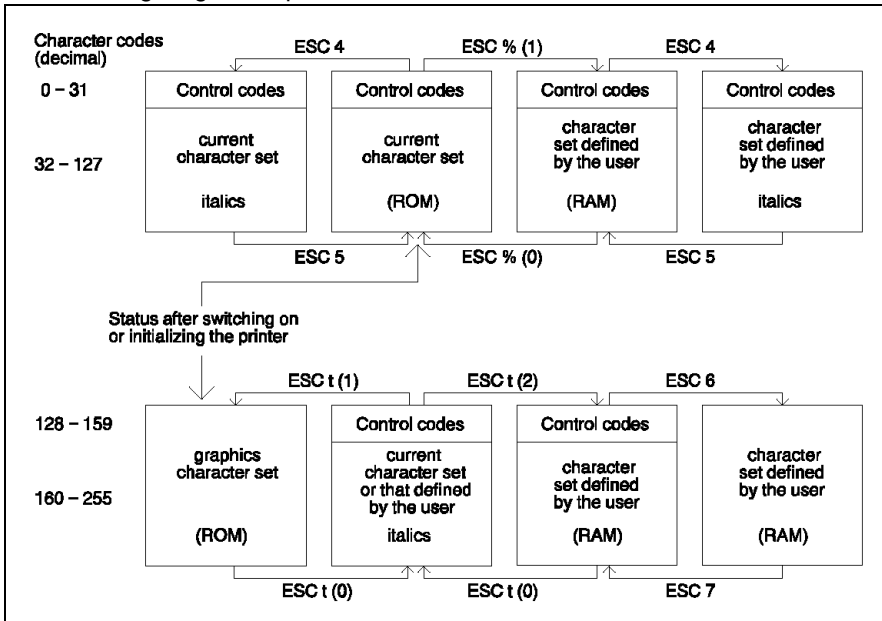
A character defined by the user is assigned to the ASCII code 65 (capital letter A of the basic character set). The character sequence "AAA" is printed before and after switching to the user-defined character set.

```
BEGIN
  PRINTLF( "AAA" )
  PRINT( char( 27 ) , "% " , char( 1 ) ) ;
  PRINTLF( "AAA" )
END
```

Result:

```
AAA
↑↑↑
```

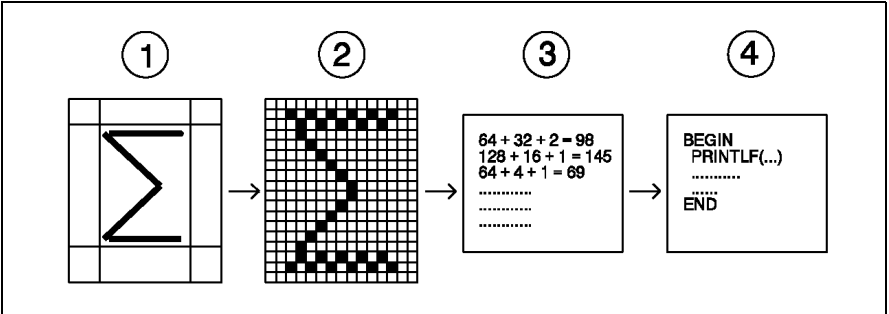
The following diagram explains the selection of the different character sets:



- The character set defined by the user can be switched on using **ESC % (1)** in the lower character table or using **ESC t (2)** in the upper character table.
- After the control command **ESC 6** has been entered, the complete upper character table for characters defined by the user can be used.
- During definition, the characters defined by the user are assigned codes from 0 to 127. If the character set defined by the user is switched on in the upper character table, 128 must be added to the codes in order to print the desired character. For example, PRINT (char (128 + 60)) prints the character defined under the code 60. Thus, basic characters and characters defined by the user can be printed simultaneously without switching the character set.
- Using **ESC 4**, the characters defined by the user in the lower character table can be printed in italics.

Definition of characters

For the definition of a new character the following steps are necessary:



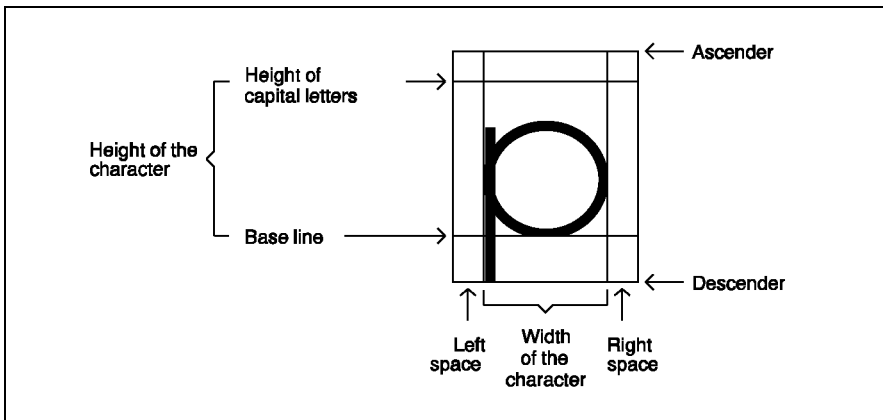
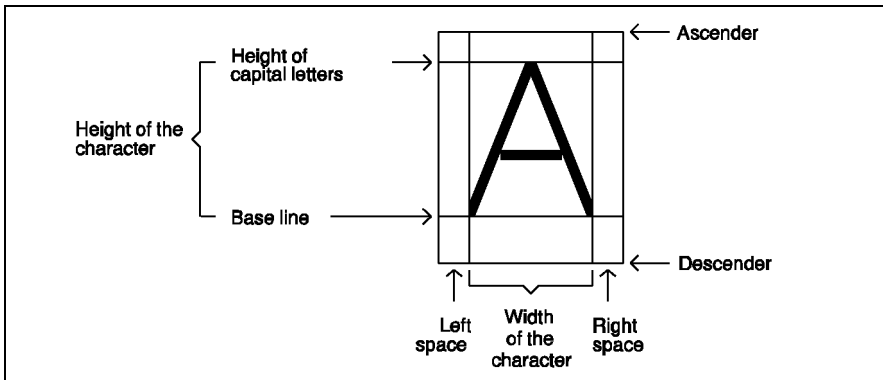
1. Design of a character
2. Transferring the design to a dot grid
3. Encryption of the dot pattern into a number sequence
4. Transferring the number sequence to the printer using the control command **ESC &**.

Design of a character

A character is depicted according to the following points:

- type image, i. e. 'form of the character'
- relative height and width of the character in comparison to the other characters of the character set
- position of the character in relation to the base line (print line)
- descender or ascender
- left or right space.

The following diagrams show the design of a capital letter and a small letter with descender:



Transferring the design onto a dot grid

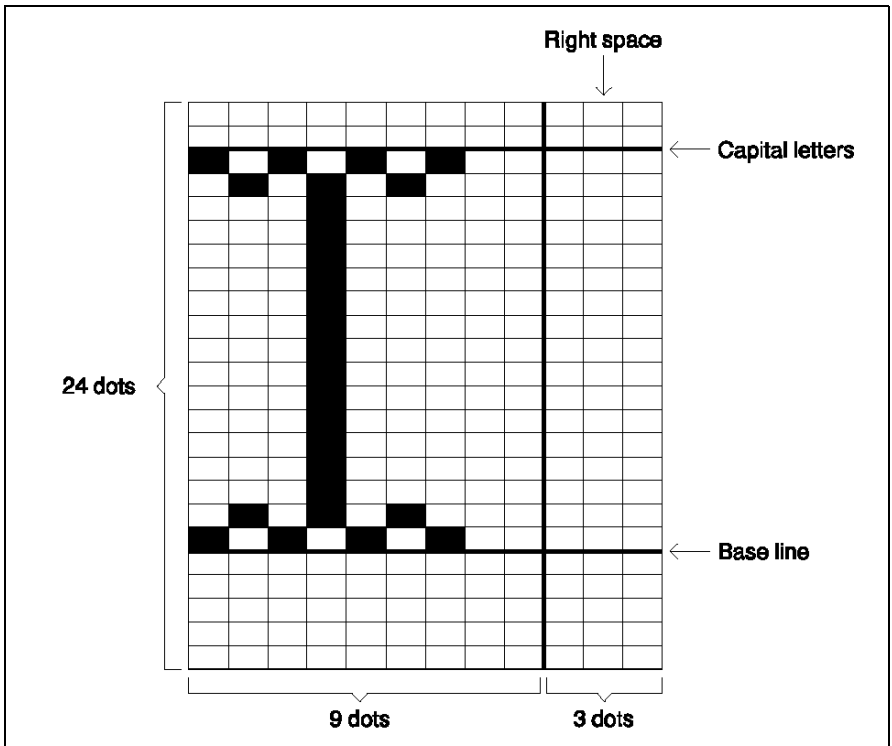
The document printer prints characters as dot patterns. A character consists of a maximum of 24 dots in a vertical direction (spacing 1/180 inch). In a horizontal direction, the number of dots and the density depend on the print quality:

- 9 dots (spacing 1/120 inch) in draft print quality
- 29 dots (spacing 1/360 inch) in LQ print quality
- 37 dots (spacing 1/360 inch) with proportional spacing.

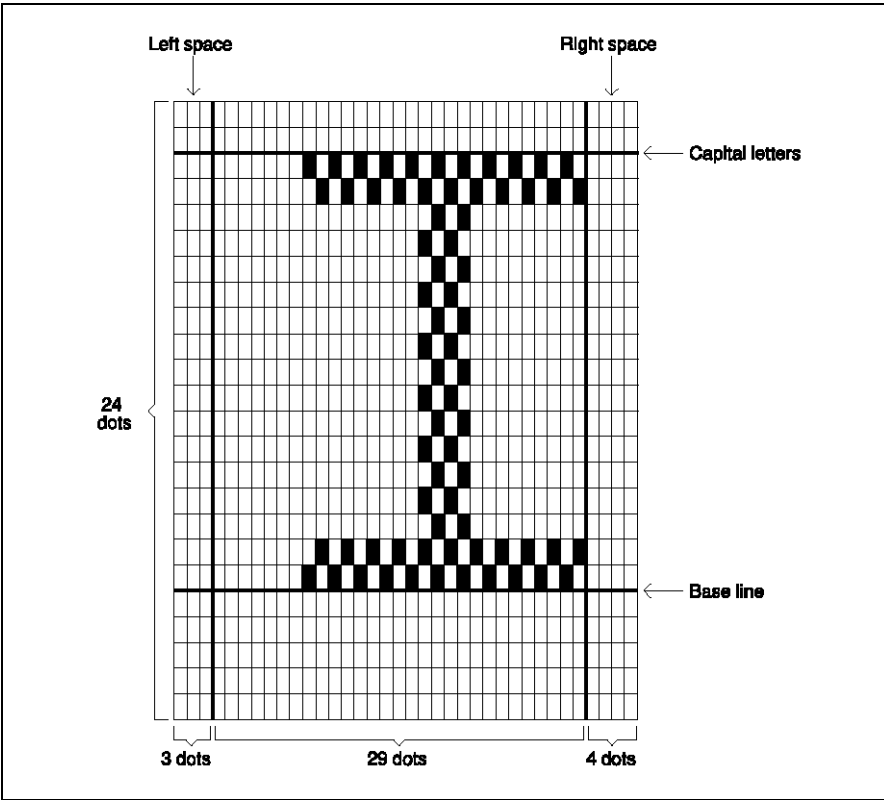
To ascertain the dot pattern, the character design is transferred onto a dot grid appropriate to the desired print quality.

The following diagrams show the dot patterns for the character 'l' on different dot grids.

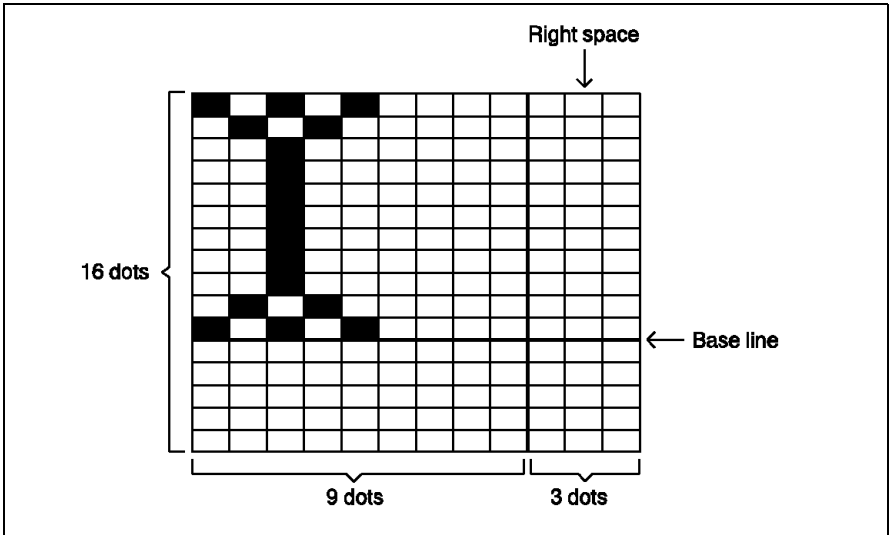
Dot grid for draft print quality:



Dot grid for LQ print quality:



Dot grid for superscript or subscript characters in draft print quality:



The extent of the dot grid is determined by the print quality and the print mode.

The following table contains the number of dots (columns) in a horizontal and vertical direction for the various character types:

Print quality/ print mode	Charac- ter width	Complete width of left and right spaces	Complete width of the character	Character height with descen- der and ascender
Draft print quality	9	3	12	24
LQ print quality	29	7	36	24
Proportional spacing	1-37	0-5	1-42	24
Superscript/subscript (draft)	9	3	12	16



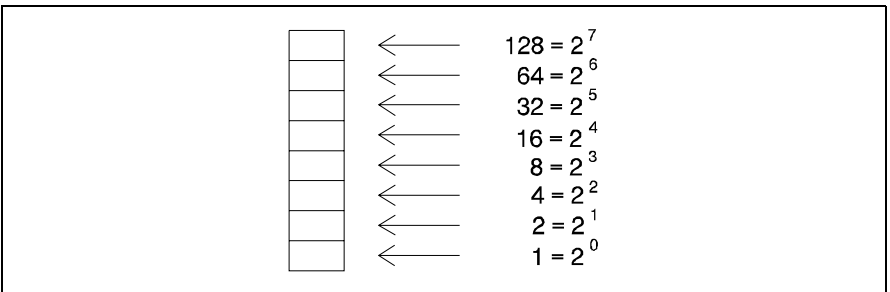
- On a dot grid, dots may not be set directly beside each other horizontally. A dot position must remain free to the right and to the left of each dot to be printed.
- In normal print, the complete width of a character (including the left and the right space) is fixed. Each character occupies 12 (draft) or 36 (LQ) horizontal dot positions. With proportional spacing, only the number of horizontal dots is printed specified by the character definition (see the next section “Encryption of the dot pattern”). The maximum complete width of a proportional character is 42 dots.
- The complete width of the space, i. e. the distance to the next or previous character, can be divided up at will between the left and/or right space, for example, left space = 0, right space = 3 or left space = 2, right space = 1 with the complete width of the space as 3 dots (draft).
- For superscript and subscript characters, the same dot grids can be used depending on the print quality and print mode. They are 16 dots high and 12 dots (draft), 36 dots (LQ) or maximally 42 dots (proportional) wide. With superscript characters the upper 16 needles of the print head are used, with subscript characters the lower 16 needles.

Encryption of the dot pattern into a number sequence

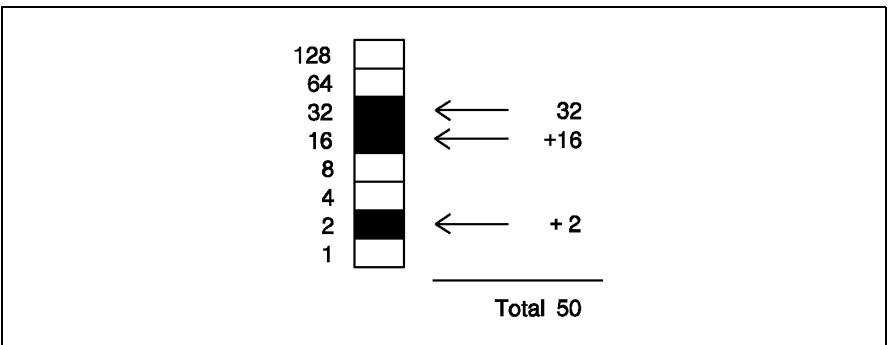
Before being transferred to the printer, the dot pattern of a newly defined character must be encrypted into a sequence of data bytes, i. e. into numbers between 0 and 255.

For this, the grid is divided into columns each of eight dot positions lying one beneath the other (squares). The encryption of such a dot column takes place according to the following system:

Each square of the dot column from the top to the bottom in descending order is assigned a value of a power of two:



The encryption of the dot column is the total of the powers of two of all squares which contain a dot, for example:



The total of a column, which contains no dots, is 0; the total of a column, in which all the dots are set, is 255.

Transferring the number sequence to the printer

When the complete dot pattern of a character is encrypted as a number sequence, this number sequence is transferred to the printer (RAM) using the control command **ESC &**. Subsequently the character can be printed as a character defined by the user.

If several characters are to be defined, normally each character definition must be transferred separately using **ESC &**. Only characters of a continuous alphabet range - for example, A – E or J – U, but not C, J and N - can be defined using one **ESC &** command.



Before the encryption (number sequence) of a character defined by the user can be transferred with **ESC &**, the print quality (LQ or draft) appropriate for the character definition and the appropriate print mode (proportional spacing or superscript/ subscript) must be set on the printer. If, for example, an LQ character is defined, the print quality must first be set to LQ using **ESC x (1)**. If another mode is activated during the transfer, the characters cannot be used.

If more than one character is defined, all the number sequences (sequences of data bytes) are added successively. The number of data bytes depends on the width (parameter d1) and the height (24 or 16 dots) of the dot grid used:

Number of data bytes per character to be transferred:

- with normal character height (24 dots = 3 bytes)
Number of bytes = $d1 * 3$
- with superscript/subscript characters (16 dots = 2 bytes)
Number of bytes = $d1 * 2$

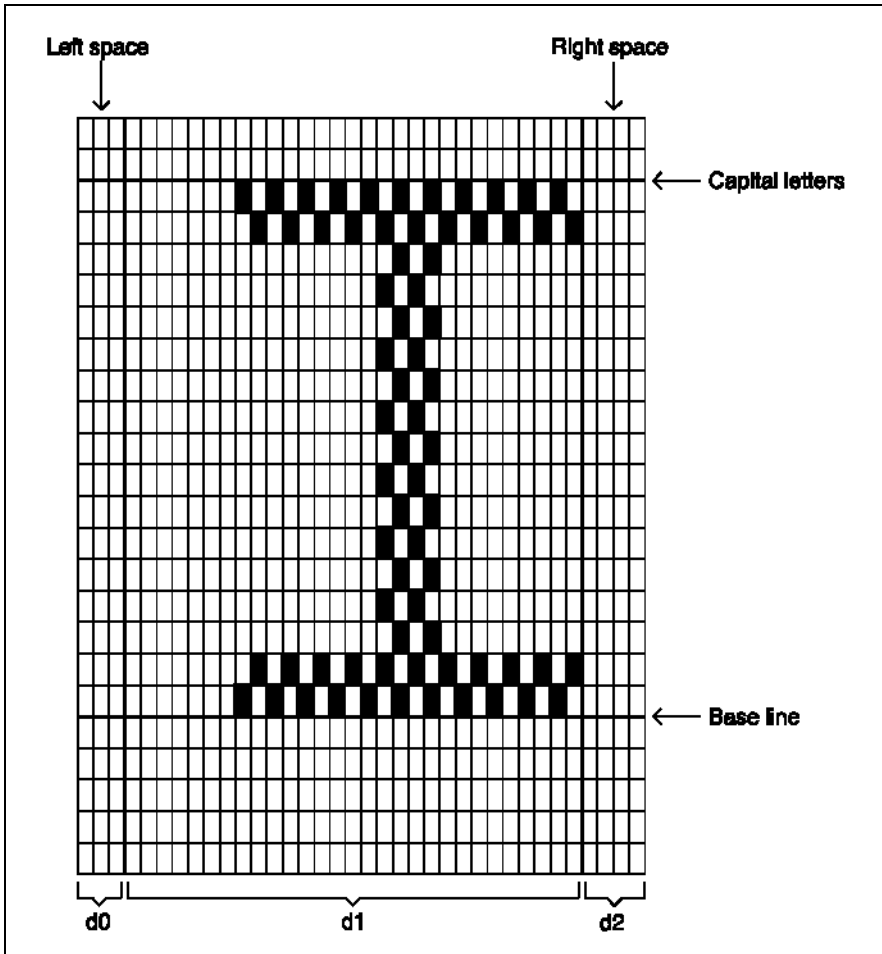
The number of data bytes to be transferred according to the formula above must be kept to **exactly**. If too little data is transferred using **ESC &**, subsequent control commands or character codes may be interpreted as character data. Also, too much data is interpreted as control commands or character codes.

Using the control command **ESC &**, the data bytes of one or more characters defined by the user can be transferred:

ESC & (n1) (n2) (n3) (d0) (d1) (d2) (data 1) (d0) (d1) (d2) (data 2) ...

The meaning of the individual parameters is explained in the command description of **ESC & ...** (see section "Transferring the character definition" in this chapter).

Meaning of the parameters d0, d1, d2:



Example of the definition of a draft character

The example shows the following steps:

- Definition of a draft character under the character code of the letter A (left space two dot columns, character width nine dot columns, right space one dot column).
- Printing of the newly defined character in normal, elongated and italic print.

```

BEGIN
  PRINT(char(27), "&", char(0), "AA")      <- character A
  PRINT(char(2,9,1))                    <- Character width
  PRINT(table)                           9 dot columns
  PRINTLF("AAAABCDEFGF")
  PRINT(char(27), "%", char(1))
  PRINTLF("AAAABCDEFGF")                 <- B to G not newly
  PRINT(char(14))                         defined
  PRINTLF("AAAABCDEFGF")
  PRINT(char(27), "4")
  PRINTLF("AAAABCDEFGF")
END

BEGIN table
  char(8,0,0,16,0,0,32,0,0)
  char(64,0,0,255,255,255,64,0,0) <- Charcter width 9,
  char(32,0,0,16,0,0,8,0,0)       i.e. 27 data bytes
END table

```

Result:

```

AAAABCDEFGF
↑↑↑↑
↑↑↑↑
↑↑↑↑

```

Example of the definition of LQ characters:

The example shows the following steps:

- Definition of two proportional LQ characters under the character codes of the letters A and B; the character width of the first character amounts to ten dot columns, that of the second character eighteen dot columns.
- Printing of the newly defined characters in normal and elongated print.

```

BEGIN
PRINT(char(27),"p",char(1))           New definition A
PRINT(char(27),"&",char(1),"AB") <-- and B (proport.)
PRINT(char(3,10,1))                   <-- Different
PRINT(table 1)                         character
PRINT(char(3,18,1))                   <-- widths
PRINT(table 2)
PRINTLF("ABABABCDEF")
PRINT(char(27),"%",char(1))
PRINTLF("ABABABCDEF")                 <-- C to G not newly
PRINT(char(14))                       defined
PRINTLF("ABABABCDEF")
END

BEGIN table 1
char(0,8,0,0,4,0,0,8,0,0,4,0)
char(0,132,64,0,72,128,0,165,64)
char(0,90,128,0,37,0,0,26,0)
END Table 1

BEGIN table 2
char(0,8,0,0,4,0,0,8,0,0,4,0)
char(0,8,0,0,4,0,0,8,0,0,4,0)
char(0,8,0,0,4,0,0,8,0,0,4,0)
char(0,132,64,0,72,128,0,165,64)
char(0,90,128,0,37,0,0,26,0)
END table 2
    
```

Result:

```

                ABABABCDEF
                ↪↪↪↪
                ↪↪↪↪↪↪↪↪
    
```

Notes on the use of user defined characters

This section contains some general notes on the use of characters defined by the user.

Storage of characters defined by the user

The characters defined by the user are stored in the RAM of the printer. Only one character set can be loaded. When switching off the printer, the set of characters defined by the user is deleted. Therefore, it must be possible at any time to re-load the characters.

The control command **ESC @** does not delete the character set defined by the user.

Characters defined by the user in various print qualities

By means of the control command **ESC %**, the character set defined by the user is selected. To print the characters, the print quality (draft or LQ) appropriate to the character definition and the appropriate print mode (proportional spacing or superscript/ subscript) must also be activated.

For example, if draft characters were defined (i. e. the draft print quality was activated **before** the character definition using **ESC &**), the draft print quality must be switched on.

If you change to a different print quality or print mode the user defined graphics can not be used.

Print effects of characters defined by the user

For characters defined by the user, the same print effects are available as for normal characters:

- bold print, double impact print
- condensed print, elongated print
- italic print
- underlining
- character sizes 10, 12, 15 cpi

Transfer of the resident character set (Download)

If only a few characters within a resident character set (for example, LQ type font or the standard type in draft quality) are to be newly defined, the desired resident character set can be copied into the RAM using the command **ESC : before** defining the characters. The character set is then considered to be defined by the user and can **subsequently** be modified character by character via **ESC &** (see description of the control command **ESC :** in the following section, “Syntax of the character set commands”).

Syntax of the character set commands

This section extensively describes the syntax of the control commands for the character set selection and the character definition. Exact notes and program examples are contained in the previous sections.

Switching on italic print

ESC	4	ASCII character
27	52	Decimal
1B	34	Hexadecimal

Function:

Italic print is switched on using **ESC 4**. The characters of each current character set, i. e. draft standard type, LQ type or characters defined by the user will subsequently be printed in italics..

- i** – The italic characters can be addressed in the lower character table after entering **ESC 4**.
- Italic print is switched off again using **ESC 5**. In the upper character table, italic characters can still be addressed (see **ESC t (n)**).
- **ESC 4** can also be used if the graphics character set was activated using **ESC t (1)**. However, the graphics characters are not printed in italics.

Example:

```
BEGIN
  PRINTLF("Draft normal")
  PRINT(char(27),"4")
  PRINTLF("Draft italic")
  PRINT(char(27),"x",char(1))
  PRINTLF("LQ italic")
END
```

Result:

```
Draft normal
Draft italic
LQ-italic
```

Switching off italic print

ESC	5	ASCII character
27	53	Decimal
1B	35	Hexadecimal

Function:

Italic print activated using **ESC 4** is switched off again using **ESC 5**.



In the upper character table, italic characters can be addressed even after entering **ESC 5** (see **ESC t (n)**).

Selecting the character set

ESC	t	(n)	ASCII character
27	116	n	Decimal
1B	74	n	Hexadecimal

Function:

Using **ESC t (n)**, one of the following character sets of the complete upper character table is selected:

- Italic character set (n= 0)
The upper character table contains the italic characters of the current character set (draft, LQ or defined by the user). The upper control code table contains control codes (identical to those of the lower control code table).
- Graphics character set (n= 1)
The complete upper character table contains graphics characters and international special characters.
- Character set defined by the user (n= 2)
The upper character table contains the characters defined by the user. These characters can be used simultaneously with the standard characters (ROM) without switching character set. For this, 128 must be added to each code assigned with **ESC &** when defining the characters.

- i**
- The introductory section “Selection of the character set” in this chapter contains the character tables of the individual character sets.
 - If **ESC t (2)** is used without previously defining characters, the upper and lower character tables are identical.

Selecting a national character set

ESC	R	(n)	ASCII character
27	82	n	Decimal
1B	52	n	Hexadecimal

Function:

Altogether twelve character codes of the basic character set (hex 23, 24, 40, 5B-60 and 7B-7E) can be occupied with national special characters using the command **ESC R (n)**. By means of a value between 0 and 12 for n, one of thirteen possible country versions is selected according to the following list:

- n = 0 : USA
- n = 1 : France
- n = 2 : Germany
- n = 3 : Great Britain
- n = 4 : Denmark
- n = 5 : Sweden
- n = 6 : Italy
- n = 7 : Spain 1
- n = 8 : Japan
- n = 9 : Norway
- n = 10 : Denmark
- n = 11 : Spain 2
- n = 12 : Latin America



- A summary of all the country- specific characters and their encryption (hexadecimal, decimal) is contained in the introductory section “Character set selection” in this chapter.
- The country versions of the ISO 8859 character set also are selected via the command **ESC R (n)** (see “Selection of type fonts/ character sets” in the chapter “Additional commands”).

Switching on/off the character set defined by the user

ESC	%	(n)	ASCII character
27	37	n	Decimal
1B	25	n	Hexadecimal

Function:

Using **ESC % (n)** the character set defined by the user is switched on. Characters defined by the user will only be printed if the currently selected print quality (draft or LQ) and the current print mode (proportional or superscript/ subscript) correspond to the character definition.

n = 0: user-defined character set off

n = 1: user-defined character set on

i The sections “Character set selection” and “Character definition” contain further notes and program examples for the command **ESC % (n)**.

Switching on extended character set

ESC	6	ASCII character
27	54	Decimal
1B	36	Hexadecimal

Function:

The command **ESC 6** influences the complete upper character table. The effect of the command depends on the character set activated using **ESC t (n)**:

- The upper character table contains characters defined by the user. In this case, after entry of the command **ESC 6**, the upper control code table for characters defined by the user can also be used. When defining the characters, the codes from hex 00 to hex 1F must be assigned to these characters.
- The upper character table contains graphics characters. The upper control code table is then occupied by further special characters.
- The upper character table contains italic characters. In this case, the command **ESC 6** is ignored.



The introductory section “Character set selection” in this chapter contains further notes on the command **ESC 6**. This section also contains the characters of the upper control code table for the extended graphics character set.


Switching off extended character set

ESC	7	ASCII character
27	55	Decimal
1B	37	Hexadecimal

Function:

The command **ESC 7** influences the complete upper character table. The effect of the command depends on the character set activated using **ESC t (n)**:

- The upper character table contains characters defined by the user. **ESC 7** cancels the effect of the command **ESC 6**. The upper and lower control code tables are identical.
- The upper character table contains graphics characters. After **ESC 7** is entered, the upper and lower control code tables are identical.
- The upper character table contains italic characters. In this case, the command **ESC 7** is ignored.

 The introductory section “Character set selection” in this chapter contains further notes on the command **ESC 7**.

Copying the character set into the RAM

ESC	:	NUL	(n)	NUL	ASCII character
27	58	NUL	n	NUL	Decimal
1B	3A	NUL	n	NUL	Hexadecimal

Function:

It is advisable to use this command when only a few characters of a resident character set are to be modified.

Before the definition of a new character (using **ESC &**), any resident character set can be copied into the RAM of the printer using **ESC :**

The desired resident character set, for example the draft standard character set or an LQ type font, is activated for this using the appropriate control command, for example, using **ESC x (1)** (LQ character set) or **ESC S (n)** (superscript/ subscript). Subsequently, the current character set is copied into the RAM using **ESC : NUL (n) NUL**. n is the number of the LQ type font specified in the standard command **ESC k (n)**, for example (see “Standard commands” chapter, section “Selecting the LQ type font (**ESC k (n)**)”).

Transferring the character definition

ESC	&	(s)	(n)	(m)	Data	ASCII character
27	38	s	n	m	Data	Decimal
1B	26	s	n	m	Data	Hexadecimal

Function:

Using the control command **ESC &**, the encryption (number sequence) of one or more characters defined by the user can be transferred:

ESC & (s) (n) (m) (d0) (d1) (d2) (data 1) (d0) (d1) (d2) (data 2) ...

The parameters have the following meaning:

- **s** is the number of the desired LQ type font (see control command **ESC k (n)**). If a character is to be defined in draft print quality, 0 must be entered.
- **n** is the character code of the first character to be defined.
- **m** is the character code of the last character to be defined. If only one character is defined, n and m are identical.
- **d0** indicates the number of vertical dot columns for the left space of a character.
- **d1** indicates the number of vertical dot columns for the width of a character (draft: 9 columns, LQ: 29 columns, proportional: 1- 37 columns, see previous sections).
- **d2** indicates the number of vertical dot columns for the right space of a character.
- Following the parameters d0 to d2 the **data** bytes of the character definition (number sequence) are specified.

When defining several characters, the parameters d0 to d2 and the data bytes of the character definition are specified for each character in alphabetical order.



The section “Character definition” in this chapter contains further notes and application examples for the command **ESC &**.

Graphics commands

The instruction set of the document printer contains commands for printing graphics, for example, drawings, diagrams or pictures.

There are two different approaches to printing graphics:

- Graphics printing in text mode
The graphics are composed from individual graphics characters (upper character table) (see chapter “Character set commands”).
- Graphics printing in graphics mode (dot graphics)
The graphics are printed as dot graphics. In other words, the individual pixels, from which the graphics are composed, are transferred to the printer encrypted as number sequences. With a maximum density of 180 x 360 dots per inch, the printing of more complicated pictures is also possible.

This chapter describes the commands for printing in graphics mode:

Command	Function	
ESC * (s) (n) (m) data	Selecting graphics mode	☺
ESC K (n) (m) data	Switching on graphics mode 'single density'	
ESC L (n) (m) data	Switching on graphics mode 'double density'	
ESC Y (n) (m) data	Switching on graphics mode 'double density and double rate'	
ESC Z (n) (m) data	Switching on graphics mode 'quadruple density'	
ESC ? (m) (s)	Reassign graphics commands	



- General notes on the command description can be found in the chapter “Standard commands” in the sections “Description components”, “Coding of decimal command parameters” and “Program examples”.
- The document printer works in different graphics modes. A graphics mode is labelled by the number of print head needles addressed when printing, (8 needles or 24 needles) and by the horizontal dot spacing (60 – 360 characters per inch).
- The graphics commands switch on one of the graphics modes (exception: **ESC ?**). A defined set of the subsequently transferred data is interpreted as a dot pattern, similar to the definition of a character. The exact quantity depends on the selected graphics mode and the parameters specified in the command.
- In many cases, graphics can also be displayed with a commercially available program on the screen of the computer and then printed as a so-called “Screen Dump”. As long as the program uses the appropriate graphics commands, the screen image and the printout will match.
- All the graphics modes of the document printer can be switched on using the command **ESC ***.

Graphics modes

The graphics modes of the document printer are identified by the number of vertically arranged dots, which the print head prints in a graphics line, i. e. by the number of print head needles addressed during the printing operation:

- 8- dot mode
In one graphics line, 8 dots spaced at 1/60 inch can be printed vertically. In this mode, six different horizontal dot spacings are available.
- 24- dot mode
In this mode, 24 dots spaced at 1/180 inch can be printed vertically. Five different horizontal dot spacings are available.

All graphics modes can be switched on using the command **ESC * (m) (n1) (n2)** by means of the selection of the parameter **s**. The following table shows the dot densities (in dots per inch) of the various graphics modes and the corresponding parameter **s**:

s	Graphics mode	needles used	horizontal dot density	vertical dot density
0	single density	8	60	60
1	double density	8	120	60
2	double rate double density	8	120	60
3	quadruple density	8	240	60
4	screen graphics	8	80	60
6	screen graphics 2	8	90	60
32	single density	24	60	180
33	double density	24	120	180
38	screen graphics 2	24	90	180
39	triple density	24	180	180
40	sextuple density	24	360	180

Mode of operation of the graphics commands

This section describes the mode of operation of the graphics commands.

The graphics commands are structured as follows:

ESC command identifier (n) (m) data ...

Command identifiers are the letters K, L, Y, Z or * (s). Via entry of the identifier, with **ESC** * by means of entry of the parameter s, one of the graphics modes of the document printer is switched on. The number of dots printed vertically in a dot column is now fixed (8-dot or 24-dot mode).

The parameters n and m determine the number of dot columns to be printed:

$$\text{number of dot columns} = m * 256 + n.$$

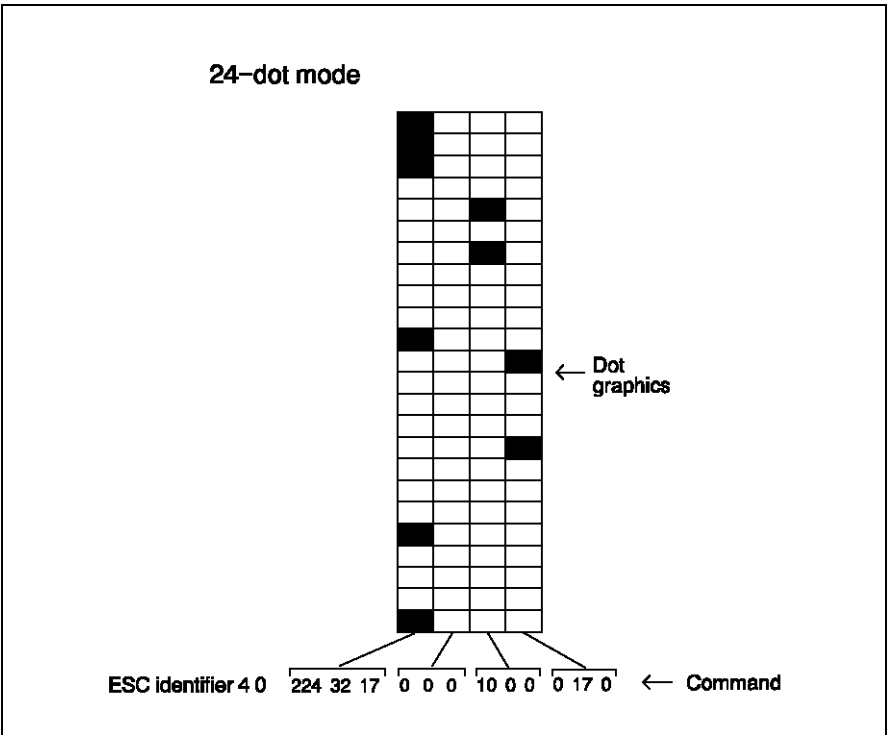
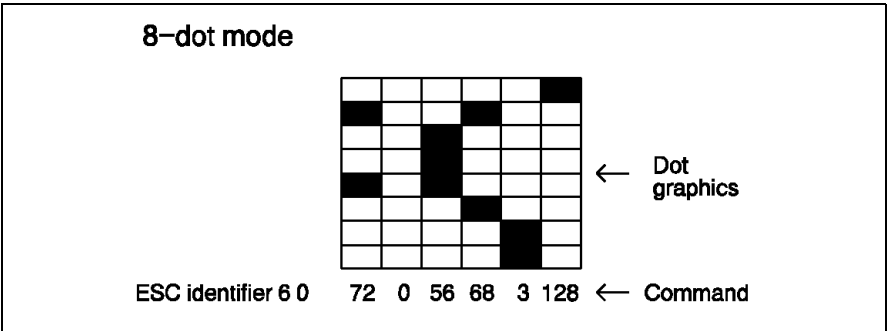
The subsequent data contains the information encrypted in numbers between 0 and 255 (bytes) about the dots from which the graphics are to be composed. The encryption takes place as described in the section "Character definition" of the "Character set commands" chapter.

The total number of data bytes is calculated from the parameters n and m:

$$\text{Number of data bytes} = m * 256 + n \text{ (8-dot mode)}$$

$$\text{Number of data bytes} = 3 * (m * 256 + n) \text{ (24-dot mode)}$$

Example:



The total number of data bytes must be adhered to exactly. If too many data bytes are entered, some may be interpreted as character codes. If too few data are entered, subsequent control or character codes may be interpreted as graphics data.



- With 8-dot graphics modes 'double rate, double density' and "quadruple density", horizontally adjacent dots cannot be printed. This is also the case for the 24-dot graphics mode 'sextuple density'.
- For extensive graphics, the dot data of several lines must normally be connected. With the normal line spacing of 1/6 inch, the picture is interrupted by blank lines. To print graphics without line spaces the line spacing must be set to 24/180 inch (corresponds to the height of a graphics line) using **ESC 3**.
- The horizontal and the vertical dot density are equal only with the 8-dot graphics mode 'single density' and the 24-dot mode 'triple density'. The various dot densities of the other graphics modes must be considered when designing graphics. Otherwise, they may lead to a distortion of the printed pictures.

Syntax of the graphics commands

Selecting the graphics mode

ESC	*	(s)	(n)	(m)	Data...	ASCII character
27	42	s	n	m	Data...	Decimal
1B	2A	s	n	m	Data...	Hexadecimal

Function:

Using **ESC * (s) (n) (m)** according to the value (s) one of the graphics modes is activated according to the following table:

s	graphics mode	needles used	horiz. density	vert. density	horizontal adjacent dots
0	single density	8	60	60	possible
1	double density	8	120	60	possible
2	double density, double rate	8	120	60	not possible
3	quadruple density	8	240	60	not possible
4	screen graphics	8	80	60	possible
6	screen graphics 2	8	90	60	possible
32	single density	24	60	180	possible
33	double density	24	120	180	possible
38	screen graphics 2	24	90	180	possible
39	triple density	24	180	180	possible
40	sextuple density	24	360	180	not possible

The parameters n and m determine the number of dot columns to be printed:

$$\text{Number of dot columns} = m * 256 + n$$

In 8-dot graphics mode, one data byte per dot column must be specified, in 24-dot graphics mode three data bytes per dot column.



The section “Mode of operation of the graphics commands” contains further notes on the command **ESC * (s) (n) (m)**.

Example:

Using shading, the various dot densities of the graphics modes are illustrated. In the main program, the parameter *s* is set for the command **ESC ***. In the subroutines EIGHT DOT and TWENTY-FOUR the command **ESC ***, the number of dot columns (100 each time) and the data bytes (encryption) of the shading (decimal 170 followed by decimal 85) are given.

```
BEGIN
  PRINTLF(" 8- dot graphics modes")
  SET m=0
  CALL EIGHT DOT
  SET m=1
  CALL EIGHT DOT
  SET m=2
  CALL EIGHT DOT
  SET m=3
  CALL EIGHT DOT
  SET m=4
  CALL EIGHT DOT
  SET m=6
  CALL EIGHT DOT
  PRINTLF
  PRINTLF("24-dot graphics modes")
  SET m=32
  CALL TWENTY-FOUR
  SET m=33
  CALL TWENTY-FOUR
  SET m=38
  CALL TWENTY-FOUR
  SET m=39
  CALL TWENTY-FOUR
  SET m=40
  CALL TWENTY-FOUR
END
```

```
BEGIN EIGHT DOT
  PRINTLF("Parameter S =",S)
  PRINT(char(27),"*",char(S))
  PRINT(char(100,0))
  SET N=0
  REPEAT
    SET N=N+1
    PRINT(char(170),char(85))
  UNTIL N=50
  PRINTLF( )
END EIGHT DOT

BEGIN TWENTY-FOUR
  PRINTLF("Parameter S =",S)
  PRINT(char(27),"*",char(S))
  PRINT(char(100,0))
  SET N=0
  REPEAT
    SET N=N+1
    PRINT(char(170),char(85))
  UNTIL N=150
  PRINTLF( )
END TWENTY-FOUR
```


Switching on the 'single density' graphics mode

ESC	K	(n)	(m)	Data...	ASCII character
27	75	n	m	Data...	Decimal
1B	4B	n	m	Data...	Hexadecimal

Function:

The 8-dot graphics mode 'single density' is switched on with **ESC K (n) (m)**.

The parameters n and m determine the number of dot columns to be printed:

$$\text{Number of dot columns} = m * 256 + n$$

One data byte must be specified per dot column.



- The section "Mode of operation of the graphics commands" contains further notes on the command **ESC K (n) (m)**.
- Using **ESC ?**, any graphics mode of the document printer can be assigned to the command **ESC K**.

Switching on the 'double density' graphics mode

ESC	L	(n)	(m)	Data...	ASCII character
27	76	n	m	Data...	Decimal
1B	4C	n	m	Data...	Hexadecimal

Function:

The 8-dot graphics mode 'double density' is switched on with **ESC L (n) (m)**.

The parameters n and m determine the number of dot columns to be printed:

$$\text{Number of dot columns} = m * 256 + n$$

One data byte must be specified per dot column.

- i** – The section “Mode of operation of the graphics commands” contains further notes on the command **ESC L (n) (m)**.
- Using **ESC ?**, any graphics mode of the document printer can be assigned to the command **ESC L**.

Switching on the 'double density and double rate' graphics mode

ESC	Y	(n)	(m)	Data...	ASCII character
27	89	n	m	Data...	Decimal
1B	59	n	m	Data...	Hexadecimal

Function:

The 8- dot graphics mode “double density and double rate” is switched on with **ESC Y (n) (m)**.

The parameters n and m determine the number of dot columns to be printed:

$$\text{Number of dot columns} = m * 256 + n$$

One data byte must be specified per dot column.



- The section “Mode of operation of the graphics commands” contains further notes on the command **ESC Y (n) (m)**.
- Using **ESC ?**, any graphics mode of the document printer can be assigned to the command **ESC Y**.

Switching on the 'quadruple density' graphics mode

ESC	Z	(n)	(m)	Data...	ASCII character
27	90	n	m	Data...	Decimal
1B	5A	n	m	Data...	Hexadecimal

Function:

The 8- dot graphics mode 'quadruple density' is switched on with **ESC Z (n) (m)**.

The parameters n and m determine the number of dot columns to be printed:

$$\text{Number of dot columns} = m * 256 + n$$

One data byte must be specified per dot column.

- i** – The section “Mode of operation of the graphics commands” contains further notes on the command **ESC Z (n) (m)**.
- Using **ESC ?**, any graphics mode of the document printer can be assigned to the command **ESC Z**.

Reassigning graphics commands

ESC	?	m	(s)	ASCII character
27	63	m	s	Decimal
1B	3F	m	s	Hexadecimal

Function:

One of the graphics modes of the document printer can be assigned to the graphics commands **ESC K**, **ESC L**, **ESC Y** and **ESC Z** with **ESC ? m (s)**.

For m, the identifier of the graphics command must be given as a character code (K, L, Y or Z). The parameter s identifies the graphics mode, as in the command **ESC ***.

Example:

The example demonstrates the assigning of the 24-dot graphics mode 'double density' (identifier = 33) to the command **ESC K**.

```
BEGIN
  PRINT(char(27), "?K", char(33))
END
```

Additional commands (Printer)

The document printer can process single documents, multiple documents (form sets) and passbooks.

This chapter explains special control commands (= additional commands) for processing documents and for processing MSR/MICR data, which are not a component of the Epson range of commands.

The description is divided into the following main sections:

- Notes on the syntax of the additional commands
- General notes on document processing
- Basic commands for document processing
- Specific commands for MSR/MICR

Certain additional commands allow the exchange of internal status information, error messages or user data between the printing units and the computer. Data transfer from the document printer to the computer is in the form of responses which have the same structure as the additional commands (CSI sequences).



Examples for the programming of the additional commands for different tasks can be found in the chapter “Application examples”.



Certain restrictions apply when printing documents (for example, non-printable areas in passbooks because of the central fold or because of the safety distance from the horizontal or vertical leading edges of a document). Ignoring this restriction can lead to poor print quality or to the destruction of documents. The restrictions when printing documents must be observed by the user. The appendix “Paper specification” contains all specifications as to which areas can or may not be printed depending on the type of document. The corresponding millimetre specifications must be taken into consideration when setting the parameters of the respective additional commands.

Structure of the additional commands

We begin with an explanation of the component parts used in the additional commands and responses.

General

Additional commands for controlling document and passbook processing and responses have, in general, the following syntactic structure:

CSI P1 ; ... ; Pn I F

Description:

	Meaning	Value/Value range		Remarks
CSI (ESC [)	Control sequence introducer	1B 5B	(ASCII)	Start value
Pi	Parameter	30-39	(ASCII)	Optional
;	Parameter separator	3B	(ASCII)	if number of parameters > 1, then compulsory
I	Intermediate character	20-2F	(ASCII)	
F	Final character	70-7E	(ASCII)	End value

- **CSI** starts the control sequence of an additional command and the sequence of responses and stands for the sequence **ESC [**.
- The parameters **P_i**, regarding number and use, depend on the respective control command. Numeric parameter values are specified as ASCII characters (in contrast to the ESC sequences of the standard, character set and graphics commands for which numeric values are transmitted to the document printer in binary form). Leading zeros need not be sent.
- Parameters are separated from each other by ; (semicolon). The assignment of a value to a parameter results only from its position within the parameter sequence (parameter position).
- If parameter positions are not occupied, the appropriate default values or the value 0 will be set implicitly.
- Even if parameter positions in a CSI command are not to be occupied, the separator ; must be set at the respective parameter position.

Example:

CSI P1;P2;P3 I F = complete command

CSI ;P2; I F = P1, P3 are default values

CSI P1;;P3 I F = P2 ist a default value

- Intermediate (**I**) and final (**F**) characters end the control sequence or a response.

Transfer of user data

The transfer of MSR data is archived by adding an STX... ETX sequence to the respective CSI command:

CSI ... I F STX...ETX

	Meaning	Value	Remarks
STX	Start of text	02 (ASCII)	for example, start data from OCR reader
ETX	End of text	03 (ASCII)	for example, end of a message from the printer

Reaction to incorrect parameters

Normally an additional command is ignored if non- decimal parameters or parameters exceeding the specified value range are transferred. This also applies if the set format height is infringed by the vertical positioning. Exceptions to these rules are given with the description of the appropriate command, as appropriate.

Responses

Responses of the document printer can be grouped as follows:

- Requested data response
- Global printer status (GPS)
- Special printer message (SPM).

Requested data responses

The basic characteristics of requested data responses are that for each response a requesting control command from the printer control was recognized (for example, request = read the MSR track, response = MSR data or error identification). These control commands are processed in series with the other print control commands.

The timing of the response cannot therefore be exactly specified. It depends on internal runtimes and the mechanical execution times of the printer.

Global printer status/ special printer messages

The data of the 'global printer status' (GPS) describes a status change within the printer control, which has been caused by an exceptional circumstance. These exceptional circumstances can be errors, operating interruptions or operating panel entries.

With the help of 'special printer messages' (SPM) these status changes will be specified in more detail.

After a 'break' on the printer interface, a 'printing unit parameters' response is created in addition to the global print status which contains information on the configuration of the printer (for example, 'maximum form width' or 'MSR function available/ not available').

Data for the global printer status, special printer messages or specifications for the printing unit parameters occur spontaneously and are stored in a stack in the printer interface until they are fetched by the system.

Notes on the command description

In the individual descriptions of the CSI commands the Pi parameters are represented as follows:

- n : one parameter
- n1; n2;n3 : parameters (in this case 3)
- n1; ... ; n5
- (0 - 9) : Value range of a parameter from 0– 9 or 0– 99 or 0– 999, etc.

Important notes on document processing

The document printer can process single documents, multiple documents and passbooks. Optionally the document printing point can also be equipped with a magnetic stripe reader (MSR).

The manual document feed is supported by an automatic document adjustment on the right- hand side.

The positioning of the print characters can be programmed for any horizontal or vertical position (reasured from document edge). For document positioning the smallest basic step is 1/180 inch. The maximum paper rate is approx. 70 lines per second for documents and passbooks.

If a document is present, the printer automatically initiates an insert. When the first print or positioning command for a document is recognized, this will be transported on to the correct processing position. If the printer receives data and no sheet is available at the document printing point, the user will be requested to insert a sheet by means of the flashing green 'PAPER LED' on the operating panel.

For application programming the selection of the horizontal leading edge is optional. The difference is that leading blanks must be ignored for horizontal positioning on a document or passbook with the horizontal leading edge on the left, while leading blanks corresponding to the physical width of the printing unit and document must be taken into account in the case of the horizontal leading edge on the right. As an alternative to the use of leading spaces, the left margin can be set as required (**ESC I (n)**).

Where precise accuracy of positioning is required, the desired print position should be reached using the least number of commands possible.

Character box

The printable areas on documents refer on the one hand to the outer edges of the documents and passbooks as well as to staggered edges and folds, on the other hand to the character box of the print character (also see appendix “Paper specification”).

'Character box' definition

The character box represents a rectangle, the width of which is specified by means of the selected character spacing:

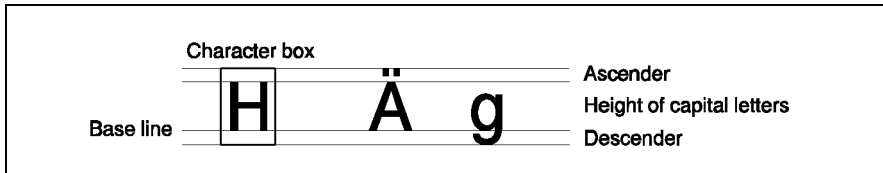
10 characters/inch : width = 1/10 inch = 2.54 mm

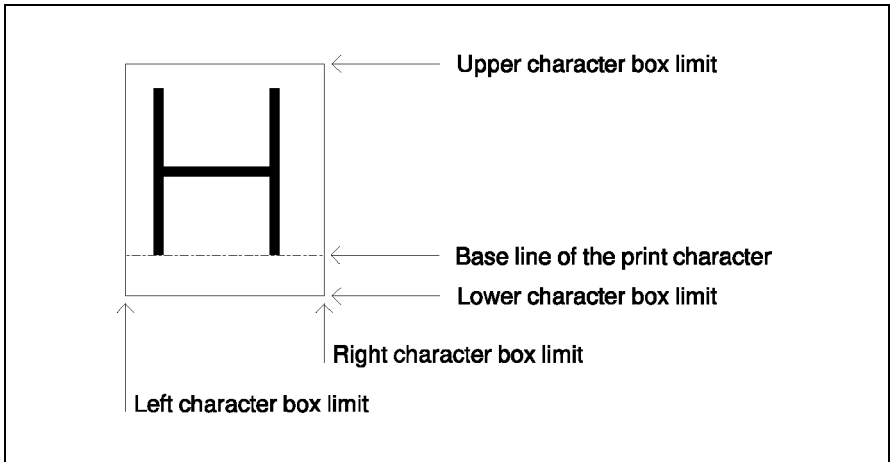
12 characters/inch : width = 1/12 inch = 2.12 mm

15 characters/inch : width = 1/15 inch = 1.69 mm

Width of the character box for proportional spacing from 1. 27 mm to 2.96 mm.

The height of the character box is defined by means of the vertical distance between the highest and lowest needles (for the document printer 3.5 mm). Within this character box each dot can be printed (blacked) via a needle.





i When printable areas are defined in this section, reference is always to the character box defined here. The capital letter 'H', used in the relevant illustrations of printable areas, only serves as an example for all print characters.

On the document printer the position of the print character within the character box is not generally determined horizontally and vertically (Epson compatibility). It is therefore wise to refer to the vertical edges of the character box (left or right character box limit) for horizontal safety distances. For vertical safety distances, selection of the base line of the print character as a reference line is recommended. The base line is the line drawn for capital letters by printing the lowest needle used. On the document printer this is normally needle 20 for standard character fonts with 10 and 12 characters/inch line spacing (needle 1 appears at the top, needle 24 at the bottom on the typeface).

Reference lines of the character box

Definition 1:

The reference line for horizontal positioning on the document printer is the left character box limit. The distances to reference lines to the left of the print character specified in the following also refer to the left character box limit. Distances to reference lines to the right of the print character specified in the following refer to the right character box limit.

Definition 2:

The reference line for vertical positioning on the document printer is the base line (needle 20). The distances between print characters and reference lines above and below the print characters specified in this manual always refer to this base line.

For measurements of the left and right character box limits, print characters are recommended which extend from the left to the right edge of the character box (for example, continuous horizontal bar (hex 2D) or block graphics characters). Capital letters are recommended for measuring the base line.

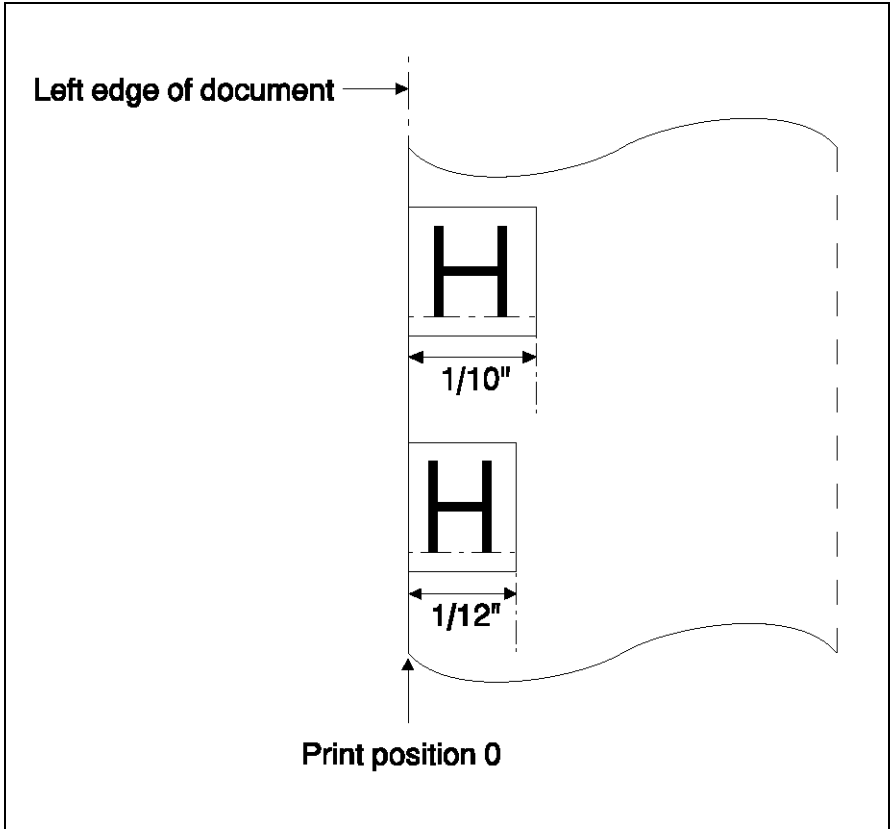
Horizontal positioning

When positioning the print head horizontally, a logical distinction must be made between the horizontal leading edges on the left and on the right.

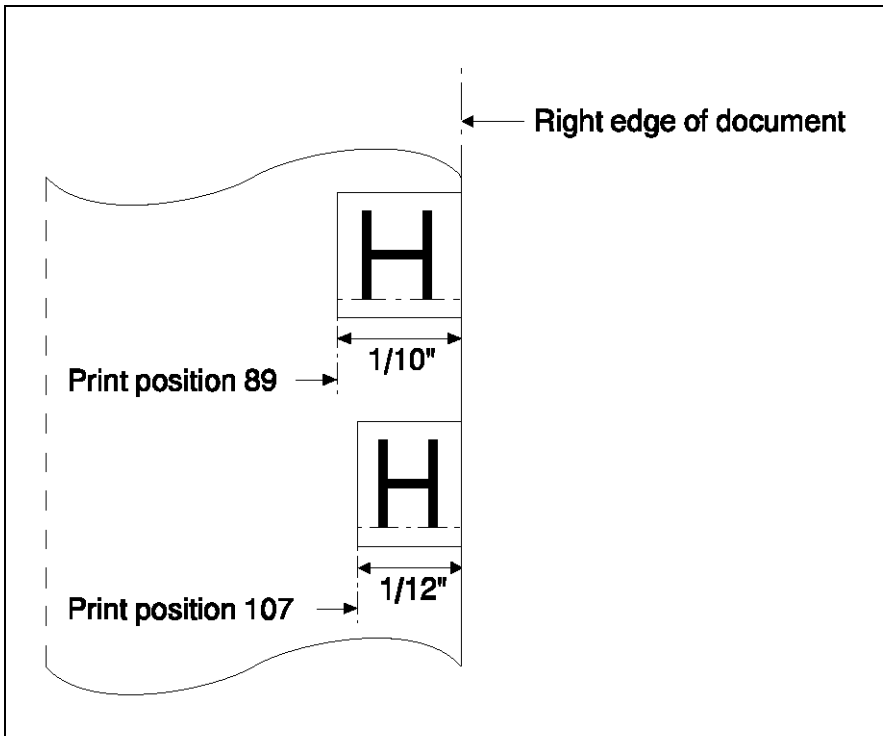
For application programming, the difference is that for the horizontal positioning on the document or passbook with the horizontal leading edge on the right, the print positions of the document in question must be converted to the print positions of the printing unit, therefore the physical width of the printing unit and of the document must be taken into consideration. If leading spaces are necessary in a print line, the left margin can be set as required (**ESC I (n)**).

Horizontal print position 0

With the horizontal leading edge on the left, the left edge of the document is identical to print position 0 for all character spacings unless a left margin was set using the standard command **ESC I (n)** (see the next subsection “Position 0 after **ESC I (n)**”). If no left margin was set, the left character box limit of the first possible print character lies on the left edge of the document:



With the horizontal leading edge on the right, the right character box limit of the 90th character (with character spacing of 10 characters/inch) lies on the right edge of the document. This means that print position 89 of the 90th character lies 1/10 inch to the left of the right edge of the document (method of counting: print position 0 for the 1st character, print position 1 for the 2nd character, etc.). With character spacing of 12 characters/inch, print position 107 for the 108th character lies 1/12 inch to the left of the right edge of the document accordingly:



Proceeding from these specifications, print position 0 can be calculated by counting backwards. The printing unit width of 90/10 inch must always be considered.

Position 0 after ESC I (n)

The horizontal print position 0 changes if a left margin was set by means of the standard command **ESC I (n)**. In this case, the left edge (= horizontal print position 0) is displaced to the right by the value n. This must be taken into consideration when calculating the actual print position 0 according to the following table (printing unit width 90/10 inch):

Logical leading edge	Left margin set	Position 0
On left	n = 0	Left edge of document
On left	n > 0	Left edge of document + n
On right	n = 0	Right edge of document -printing unit width
On right	n > 0	Right edge of document -printing unit width + n

Vertical positioning

The vertical print position is the distance from the top or bottom edge of the document to the base line of the character.

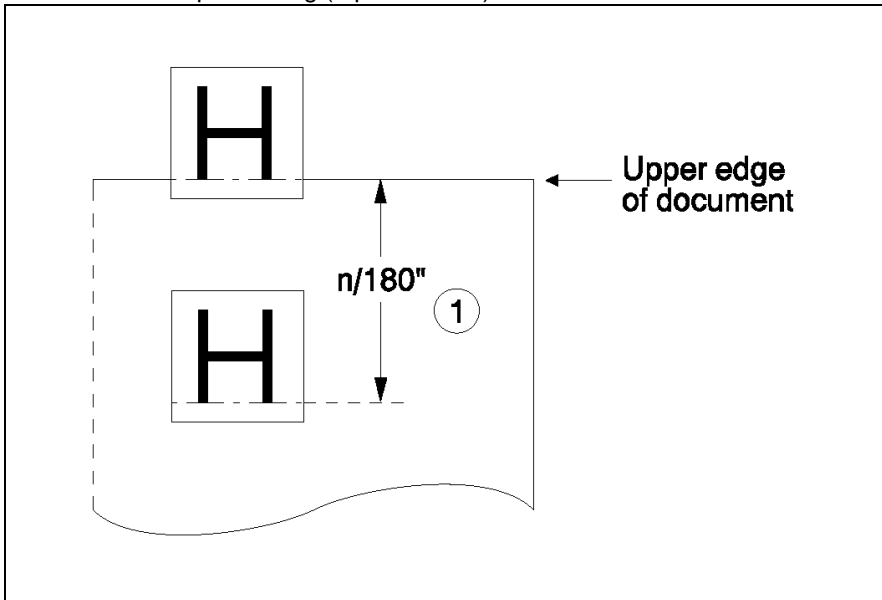
Positioning of the first printing line

The vertical first print position can be set in an area from 10/60 inch (line 1) to 80/60 inch (line 8) via the operating panel. The default setting is 30/60 inch (line 3) with a line reference of 10/60 inch. This position is valid after a document ejection (FF) but can be overwritten by means of positioning commands at any time.

Vertical print position 0

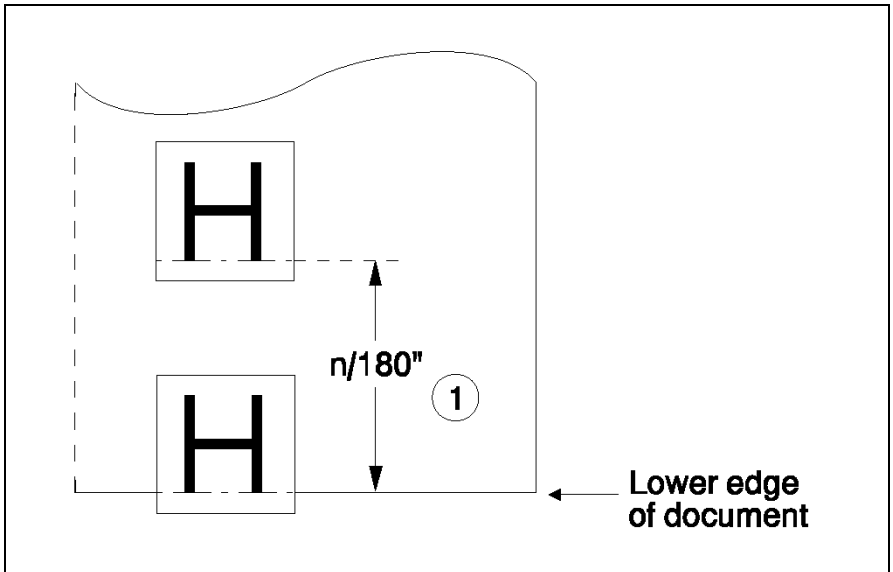
For the absolute vertical positioning of the print head, a distinction must be made between the leading edges 'upper edge of document' (top reference) and "lower edge of document" (bottom reference). Two additional commands **CSI n ! p** (absolute vertical positioning from the upper edge of the form) and **CSI n " p** (absolute vertical positioning from the lower edge of the form) are available for this. A corresponding vertical positioning of $n/180$ inch is set with the parameter n . For both methods of positioning, the base line for the vertical print position 0 is on the corresponding edge of the document.

Absolute vertical positioning (top reference):



① $n \geq 1$ is admissible; $n = 0$ causes an error message.

Absolute vertical positioning (bottom reference):



① $n \geq 1$ is admissible; $n = 0$ causes an error message.

Selection of the vertical leading edge

For performance reasons, care should be taken that the text lines are processed from top to bottom when processing documents on which the lines relate to the top of the document (top reference). With top reference, the preferred direction of the printer is the forwards movement (insertion direction). With forms designed with bottom reference, the preferred direction is the backwards movement (eject direction), so that here processing should be from the bottom to the top.

The user is free to change from bottom reference to top reference within a form.

Mixed use of character fonts

If different character fonts are to be used in one text line, care must be taken that the respective fonts have the same matrix density in order to avoid loss of performance.

Printable document areas

When printing documents, it is important not to print on the document edges or other uneven parts of the document (for example, folds or staggering) in order to avoid damaging the document or the print head. With passbook processing, the physical position of the scanning roller on the print head must also be taken into consideration. Also waves in the paper and bent up corners of documents can lead to malfunctions.

The restrictions of the printable document areas for single documents and for passbooks or multiple documents are described in the appendix "Paper specification".

All restrictions must be observed by the user when printing documents.

If the specified safety distances to the horizontal and vertical leading edges are kept to, possible tolerances (document edge detection, lop-sided pull) can be intercepted.

Basic commands for document processing

By means of the following control commands, the document processing can be controlled:

Command	Function
ESC [n \$ p	Paper feed of the document
ESC [n # q	Selection of type fonts/ character sets
ESC [n ! p	Absolute vertical positioning in relation to the top form edge
ESC [n " p	Absolute vertical positioning in relation to the bottom form edge
ESC [n # p	Relative vertical positioning backwards
ESC [" t	Requesting the document width
ESC [# t	Document edge detection
ESC [n \$ t	Activating passbook processing
ESC [n % t	Specification of the horizontal leading edge
ESC [n (t	Mode switch-over for handling end of paper
ESC [n * t	Dual station control
ESC [n , t	Multi Part

Paper feed of the document

CSI		n	\$	p	Name
ESC	[	n	\$	p	ASCII character
27	91	n	36	112	Decimal
1B	5B	n	24	70	Hexadecimal

Parameter:

n = 0 : Ejection of a document

n = 1 : Insertion of a document to the base line of the logical first line which can be set via the document printer menu (TOF- POS)

Function:

This command initiates a mechanical action. The ejection procedure also refers to documents which were only form fed and on which no insertion or print procedure was carried out.

If this command is used to eject documents (n = 0), it must be considered that after ejection the current logical position is outside the form. Therefore a new first print position must be set here before transferring new print characters, for example, using the command FF (form feed) or via paper feed of the document (positioning on the base line of the logical first line, see definition of default positioning for insertion) or using the command "Absolute vertical positioning".

i This control command triggers printing of characters still in the print buffer. It immediately causes a mechanical vertical movement which can be secured via a control cycle. Because a mechanical optimization of movement is avoided by means of the insertion command, this control command should only be used when the insertion procedure must be secured separately via control cycles.

Selection of type fonts/ character sets

CSI		n	#	q	Name
ESC	[	n	#	q	ASCII character
27	91	n	35	113	Decimal
1B	5B	n	23	71	Hexadecimal

Parameter:


n = type font or character set or font number (0 to 9999)

The font number is fixed when developing a specific character set.

Function:

Using this command by means of a type font or character set number n, special character sets (fonts) can be selected which do not belong to the standard character sets of the Epson protocol.

Extensions can thus be implemented without coming into conflict with the current and future definitions of the standard Epson protocol.

-  – If a character set under the specified number is not a component of the character sets range in the printing unit, the standard character sets are switched over to automatically. This also applies if the character set under the specified number does not contain the previously set character spacing.
- The character sets selected via **CSI n # q** do not offer the possibility of producing characters defined by the user.
- After initializing the printer, there is also a switch-over to the standard Epson character sets.

Basic commands for document processing Additional commands (Printer)

- The character fonts for the document printer have the following standard options:

DQ area = DQ
LQ area =
1. Roman
2. Sans- Serif
3. OCR-A (OCR-A1 Eurobanking)
4. OCR-B (OCR-B1 Eurobanking)

- The fonts DQ, Roman and Sans Serif can be selected using the standard commands 'Switch over print quality' (**ESC x (n)**) and 'Select LQ type font' (**ESC k (n)**). In contrast, the fonts OCR A, OCR B and ISO 8859 can only be selected by means of the additional command 'Selection of type fonts/character sets' (**CSI n #q**). The following table contains the necessary character set and font numbers:

Font	Font number
OCR-A	n = 900
OCR-B	n = 901
Roman ISO 8859	n = 600 (only with font CP15_437)
Sans-Serif ISO 8859	n = 601 (only with font CP15_437)
DQ ISO 8859	n = 602 (only with font CP15_437)

Country versions for the ISO 8859 character set are selected using the command 'Select national character set' (**ESC R (n)**):

Font	Country-specific character sets
ISO 8859-2 East Europa	n = 0
ISO 8859-5 Cyrillic	n = 1
ISO 8859-7 Greece	n = 2
ISO 8859-8 Hebrew	n = 3
ISO 8859-9 Turkey	n = 4
ISO 8859-15 Euro	n = 5

The character tables for OCR- A, OCR- B and ISO 8859 are listed in the appendix "Character set tables".

- Before using the command **CSI n # q** the printer must be switched to 'LQ print quality' (**ESC x (n)**). Otherwise the character fonts selected via this command are treated as normal LQ type fonts, this means that all standard commands (print quality and character size, types of print) also work on these fonts in the manner described in the chapter "Standard commands". No special handling takes place.

Absolute vertical positioning

Leading edge = upper edge of form

CSI		n	!	p	Name
ESC	[	n	!	p	ASCII character
27	91	n	33	112	Decimal
1B	5B	n	21	70	Hexadecimal

Leading edge = lower edge of form

CSI		n	"	p	Name
ESC	[	n	"	p	ASCII character
27	91	n	34	112	Decimal
1B	5B	n	22	70	Hexadecimal

Parameter:

n = positioning in a vertical direction by n/180 inch (n = 1 to 9999)

The permitted upper limit of the parameter value is specified by the set document height.

Function:

For document processing, two commands are available for the absolute vertical positioning (y co-ordinates) of the write head on a form. Generally, both commands, after transfer to the printer, are valid for effecting the output of the characters still situated in the print buffer. The requested vertical movement is then carried out mechanically when new write operations are executed at the document printing point.

The following differences are to be noted for the two commands for absolute vertical positioning:

- With the absolute vertical positioning in relation to the upper edge of the form (**CSI n ! p**), the spacing is specified in $n/180$ inch from the upper edge of the form to the base line of a line.
- With the absolute vertical positioning in relation to the lower edge of the form (**CSI n " p**), the spacing is specified in $n/180$ inch from the lower edge of the form to the base line of a line.

For these commands the printing unit of the document printer is fitted with equipment for the detection of the edges of the form.



The 'base line of a line' is defined in the section "Important notes on document processing".

Relative vertical positioning backwards

CSI		n	#	p	Name
ESC	[	n	#	p	ASCII character
27	91	n	35	112	Decimal
1B	5B	n	23	70	Hexadecimal

Parameter:

n = backwards positioning in a vertical direction of n/ 180 inch (n = 0 to 9999).

The permitted upper limit of the parameter value is specified by the set document height and the current line position.

Function:

Via the command **CSI n # p**, a positioning of n/ 180 inch backwards relative to the base line of the current line is executed.

After transferring this command, all characters are printed which are still in the print buffer.

Requesting the document width

Command:

CSI	"	t	Name	
ESC	[	"	t	ASCII character
27	91	34	116	Decimal
1B	5B	22	74	Hexadecimal

Response:

CSI	n	"	t	Name	
ESC	[	n	"	t	ASCII character
27	91	n	34	116	Decimal
1B	5B	n	22	74	Hexadecimal

n = document width of the current form in n/ 180 inch.

Function:

Via the control command **CSI " t**, the printer control transmits information to the program about the width of the document currently being processed.

If the width of the document is not known to the printer control at this point of time, a measuring operation is carried out to determine the document width.

The response **CSI n " t** has the same structure as the requesting command supplemented by the parameter n, which identifies the determined document width of the form with the measurement 'n/ 180 inch'. 'n' can lie in the range from 0 to 9999.

i The parameter n transmitted via **CSI " t** can be used in the program, for example, as a switch to call up the corresponding formatting and print-out routines depending on the type of form.

Document edge detection

CSI		#	t	Name
ESC	[	#	t	ASCII character
27	91	35	116	Decimal
1B	5B	23	74	Hexadecimal

Function:

The document printer ignores this function.

Activating passbook processing

CSI		n	\$	t	Name
ESC	[	n	\$	t	ASCII character
27	91	n	36	116	Decimal
1B	5B	n	24	74	Hexadecimal

Function:

The document printer ignores this function.

Specification of the horizontal leading edge

CSI		n	%	t	Name
ESC	[	n	%	t	ASCII character
27	91	n	37	116	Decimal
1B	5B	n	25	74	Hexadecimal

Parameter:

n = switch for the horizontal leading edge

n = 0 : (flush left, default value)

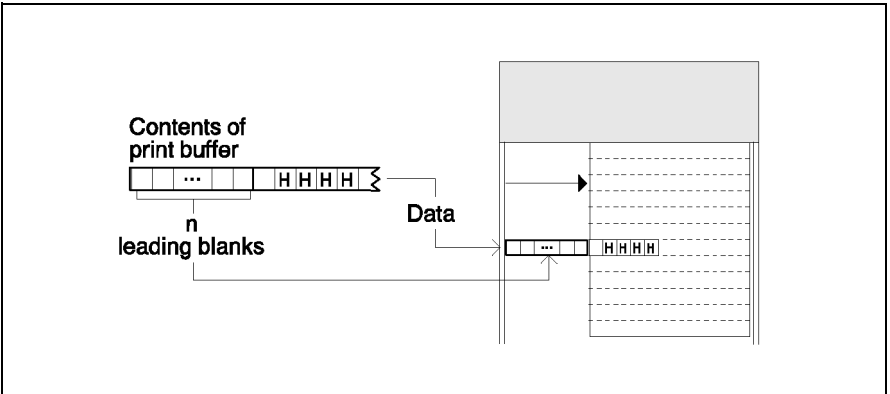
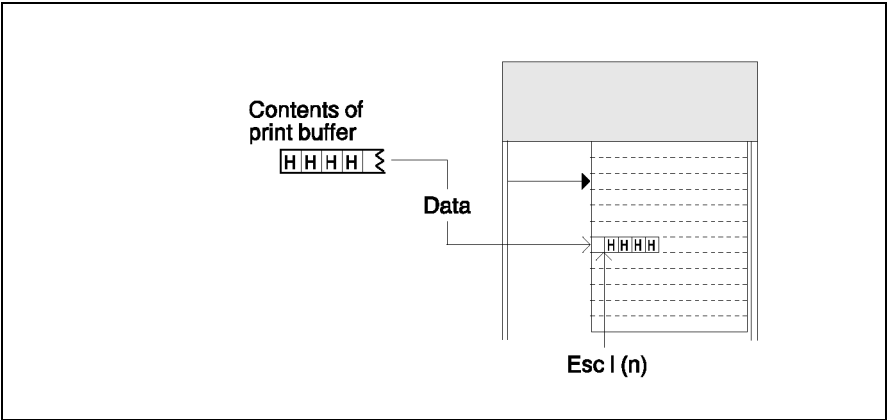
n = 1 : (flush right)

Function:

Via **CSI n % t**, the printer control is informed to which horizontal edge the subsequent print and read operations are to refer (also see section “Important notes on document processing”, subsection “Horizontal positioning” in this chapter).



- After receiving the command **CSI n % t**, all the characters are printed which are still in the print buffer.
- If the horizontal leading edge on the right is selected (n = 1), the left edge must be fixed logically depending on the physical document width and the printing unit width (90 characters @ 1/10 inch) (for example, via **ESC I (n)**) or an appropriate number of leading spaces must be taken into consideration (for example, by means of appropriate editing of the print data or by means of appropriate dot positioning).



Mode switch- over for handling end of paper

CSI		n	(	t	Name
ESC	[	n	(	t	ASCII character
27	91	n	40	116	Decimal
1B	5B	n	28	74	Hexadecimal

n = switch for type of mode switch-over

n = 0 : manual; default value

n = 1 : automatic

Function:

By means of **CSI n (t** depending on the parameter n the behaviour of the printing unit on the document printing point can be influenced in the case of the following errors (fatal errors):

PAPER LENGTH End of paper within a form:
upper or lower edge of document was passed over
because of wrong document format or incorrect
programming.

PAPER WIDENESS The print job exceeds the right document edge.

n = 0 : manual error handling

After an error the operator must clear the error via the operating panel of the printer and put the printer into ONLINE status (also see the operating manual)

n = 1 : automatic error handling

After an error the following actions are executed by the printing unit:

- Locking the printer interface for further data;
- Response 'Global printer status' in the coding **CSI n ! z** with n=2 (ERROR);
- Response 'Special printer message' in the coding **CSI n; m " z** with n=2 (NO PAPER);
- Paper ejection, deletion of all print buffers, setting of default parameters;
- Response 'Global printer status' in the coding **CSI n ! z** with n=0 (ONLINE);
- Release of the interface for the transfer of new data.

The operator no longer needs to clear the error status on the printing unit. However, after a short pause (ejection of the document) the printing unit is in the ONLINE status again for the system driver and can thus be addressed.



The default value n=0 (manual error handling) is valid after switching on the printer. Other control commands, initializations or error statuses do not change this parameter.

Basic commands for document processing Additional commands (Printer)

Use:

Control when printing lists on documents where the document length is unknown.

For each print line the program generates a control point with a uniquely marked parameter (for example, line number). In the case of an error the lines not yet printed are deleted in the printer and in the system driver. Using the control points reported back the program can now determine the rerun point after the end of the paper. Thus the data for the next document can be formatted and transferred to the printer.

As the printing unit automatically returns to the ONLINE status, the operator can continue work by inserting a new document.

The error message via the operating panel of the printer and the use of the STOP key by the operator are unnecessary.

Dual station control

CSI		n	*	t	Name
ESC	[	n	*	t	ASCII character
27	91	n	42	116	Decimal
1B	5B	n	2A	74	Hexadecimal

Parameter:

	Dual station control	USER1 LED	USER2 LED
n = 0 :	de-activated; default value		
n = 1 :	activated	off	off
n = 2 :	activated	on	off
n = 3 :	activated	off	on
n = 4 :	activated	on	on

Function:

The 'Dual station control' for the document printer can be activated using this command. In this way the control of workstations using a common printer can be synchronized.

Using the command **CSI n * t** USER1 and USER2 LEDs can be switched over in the application program in order to indicate, for example, which job is being processed or which operator is to insert a form. In order to receive a response from the respective operator, the use of the USER 1 or USER 2 key can be requested via the 'Special printer messages' (request via **CSI " z**, see section "Status and error messages" in this chapter).

- i** – In order to receive a 'Special printer message' on the status of the USER 1 or USER 2 keys, the "Dual station control" must be activated using **CSI n * t** ($n \geq 1$).
- After initializing the printer the 'Dual station control' is de-activated.

Switching on/off Multi Part

Increasing the copying power

CSI		n	,	t	Name	
ESC	[	n	,	t	ASCII character	
27	91	n		44	116	Decimal
1B	5B	n		2C	74	Hexadecimal

Parameter:

n = 0 : Switching off Multi Part

n = 1 : Switching on Multi Part for curent page

Function:

If the printout of copies is too weak, the copying power can be increased with the help of this parameter. 3 to 4 copies can be printed afterwards.

Normally this function should be switched off, as the noise level and the print head attrition will increase.

Controlling the MSR / MICR functions

The magnetic stripe reader (MSR) is a device which can optionally be integrated into the document printing point of the document printer. MSR processing is used for passbook processing, whereby relevant data is encrypted on the magnetic stripe.

The MICR (**M**agnetic **I**nk **C**haracter **R**ecognition) reader is a device that can be installed as an option at the journal print station of the document printer. MICR processing will be used for printing cheque forms.

The control of the MICR reader is implemented as an MSR component. This means that the same control sequences are used for reading the magnetic ink and the magnetic stripe.

Command	Function
ESC [n1;...; n5 ! r	Activating parameter command MSR/MICR
ESC [" r	Reading command MSR/MICR
ESC [# r STX... ETX	Writing a MSR track
ESC [% r	Deleting a track

The execution of MSR functions does not influence the current logical print position. The necessary vertical movements for the correct positioning of the passbook for MSR are controlled internally by the document printer.

After the output of a MSR command, any data still in the print buffer is printed.

i The MSR device supports the recording modes of DIN and IBM. If you are interested in further recording modes, please contact your Tally branch office.

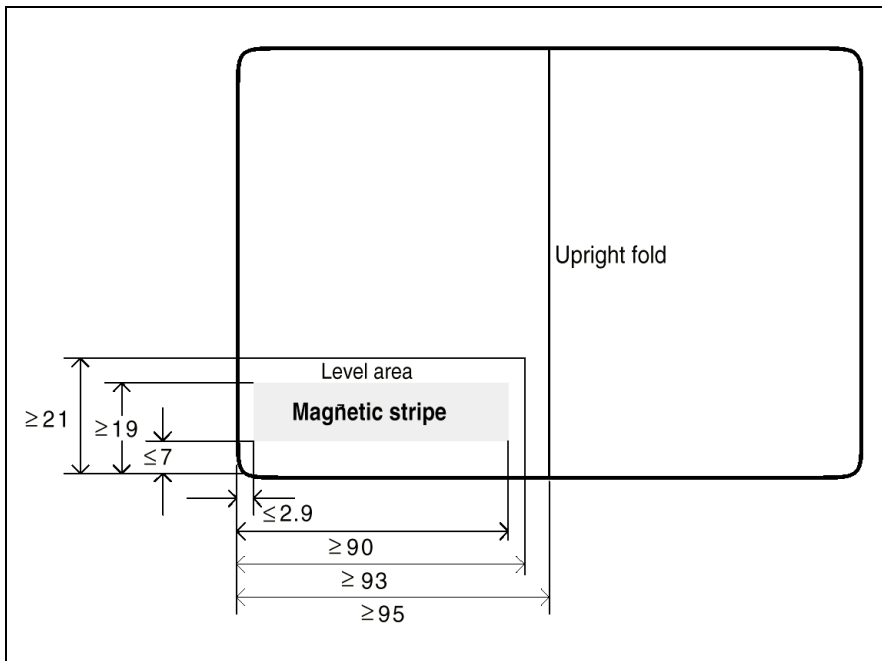
Position and measurements for MSR magnetic stripes

The print areas for passbooks with MSR processing correspond to the specifications in the appendix "Paper specification".

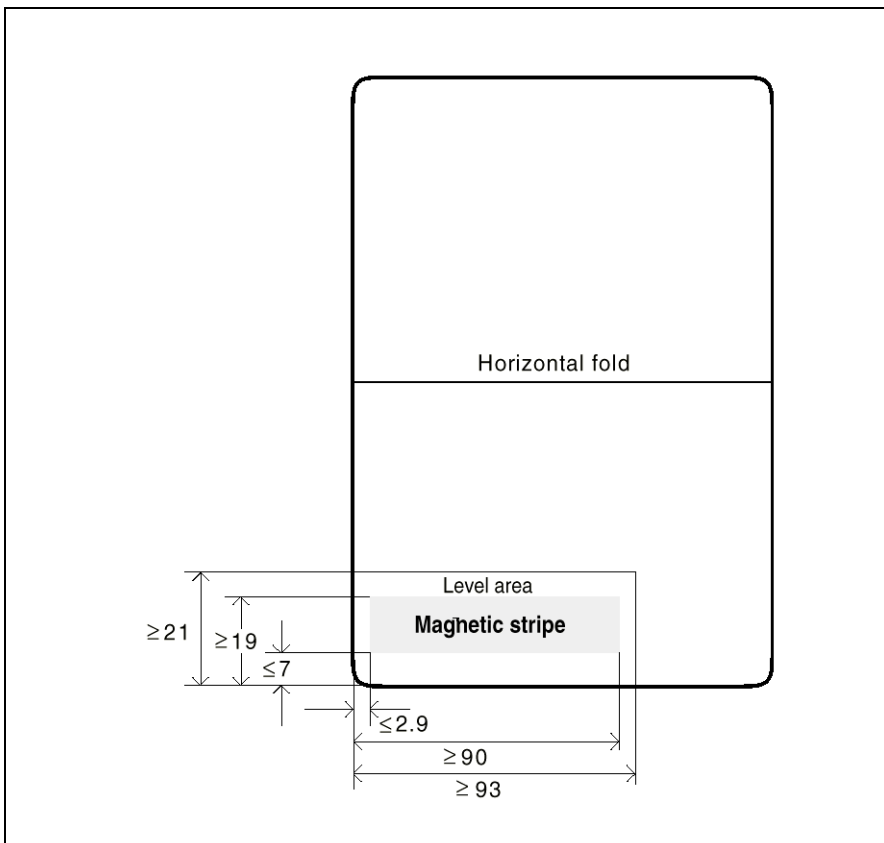
The position of a magnetic stripe on a passbook and the measurements of the magnetic stripe are fixed according to DIN 32744.

The following specifications are in mm.

Upright fold book (magnetic stripe for DIN/IBM format):



Horizontal fold book:



Parameter block MSR

CSI		n1;...;n5	!	r	Name
ESC	[	n1;...;n5	!	r	ASCII character
27	91	n1;...;n5	33	114	Decimal
1B	5B	n1;...;n5	21	72	Hexadecimal

Parameter:

- n1 = number of write repetitions (0 to 2)
- n2 = number of read repetitions (0 to 2)
- n3 = identifier for the write/ read format (number of the recording format)
- n4 = vertical distance from the form edge (0 to 9999 in the measuring unit 1/ 180 inch, thus n4/ 180 inch)
- n5 = leading edge for the vertical distance (0 = top, 1 = bottom).

Function:

CSI n1;...; n5 ! r is used to define under what conditions subsequent MSR transactions (e. g., reading or writing the magnetic stripe) are to be controlled by the MSR unit.

- Repetitions
The parameters n1 and n2 are set in case the writing or reading attempts cannot be carried out without error the first time. These actions will then be automatically repeated n1 or n2 times. If they do not deliver a correct result after repetition, the operation will be interrupted. If no data is found on the magnetic stripe the reading or writing attempt will not be repeated.
- Write/ read format; magnetic stripe position
The parameter n3 specifies the format of the data on the magnetic stripe. The position of the magnetic stripe on the passbook is defined by the two parameters n4 and n5, whereby n4 fixes the distance of the stripe in 1/180 inch steps from the edge defined by n5 (0 = top leading edge, 1 = bottom leading edge).

- Table for recording formats

Depending on the recording formats, the user must transfer the following values via **CSI ... ! r**, in order to be able to process the following recording modes:

Format	n3	n4	n5
DIN	0	14 mm (99/180")	1
IBM 1	1	11 mm (78/180")	1
IBM 2	2	11 mm (78/180")	1
105 characters	5	14 mm (99/180")	1
ISO 7811	6	14 mm (99/180")	1

- Default values:

If no parameters are set, the respective MSR transactions are carried out on the basis of the following default values:

n1 = 0 (unsuccessful writing attempts are not repeated)

n2 = 0 (unsuccessful reading attempts are not repeated)

n3 = 0 (writing of the magnetic stripe in the DIN format, reading of the magnetic stripe in the DIN/ IBM format)

n4 = 99/180 inch vertical distance from the leading edge

n5 = 1 (bottom leading edge).

- Incorrect parameters:

If incorrect parameters are used, these are reset to their default values with the exception of n3. The use of an incorrect n3 parameter (format) leads to an error message of the printer.

Reading a MSR track

Command:

CSI	"	r	Name	
ESC	[	"	r	ASCII character
27	91	34	114	Decimal
1B	5B	22	72	Hexadecimal

Response:

CSI	n1;...;n4	"	r	STX...ETX	Name	
ESC	[	n1;...;n4	"	r	STX...ETX	ASCII character
27	91	n1;...;n4	34	114	2...3	Decimal
1B	5B	n1;...;n4	22	72	02..03	Hexadecimal

n1 = number of required reading attempts

n2 = reading threshold (always = 2)

n3 = horizontal reading block number

n4 = reading error (0 = without error; > 0 = error)

STX (02h) = start of the read data area

Read data = in the range of 30h-3Fh (ASCII)

ETX (03h) = end of the read data area

Meaning of parameter n4 = reading error:

0 = no error

1 = LRC error

2 = parity error

3 = no data found

4 = no start character found

5 = incorrect flux change distance

6 = no end character found

7 = magnetic track interruption

Function:

The MSR track is read using the command **CSI " r**. The desired options are pre-set, if necessary, via the command 'MSR parameter block' (**CSI ... ! r**) (number of reading attempts, recording mode, position of the magnetic stripe, etc.). Irrespective of whether the reading attempt could be completed successfully, data for the program is transferred. In addition to the actual user data (contents of the magnetic stripe), this can also contain statistic specifications (for example, number of reading attempts) and error messages..

- i** – The command **CSI " r** triggers the output of characters still in the print buffer to the document printing point.
 - The read data block contains all the information characters, including the start and end characters for the respective recording format. The LRC character (error detection character for block protection) is internally produced and checked and is therefore not a component of the read data block.
 - With an incorrect reading attempt, the correctly recognized data up to the first incorrect character is transferred.
- Depending on the recording format, the start and end characters are hexadecimal encrypted as follows:

Format	n3	Start character	End character
DIN	0	3D	3F
IBM 1	1	3B	3C
IBM 2	2	3B	3F
105 characters	5	3D	3F
ISO 7811	6	3B	3F

- Depending on the recording format, the following user data can be read:

Format	n3	Max. number information characters	Information character range (hex)
DIN	0	45	30 to 39 + 3E
IBM 1	1	36	30to 39 + 3A 3 D 3E
IBM 2	2	36	30 to 39 + 3A 3 D 3E
105 characters	5	105	30 to 39, + 3E
ISO 7811	6	35	30 to 39 + 3A 3E

Writing a MSR track

CSI		#	r	STX...ETX	Name
ESC	[	#	r	STX...ETX	ASCII character
27	91	35	114	2...3	Decimal
1B	5B	23	72	02...03	Hexadecimal

Response (acknowledgement of the write command):

CSI		n1;n2	#	r	Name
ESC	[	n1;n2	#	r	ASCII character
27	91	n1;n2	35	114	Decimal
1B	5B	n1;n2	23	72	Hexadecimal

n1 = number of required writing attempts

n2 = error in the read after write check (0 = no error, 1 = error)

Function:

The block of characters specified via **CSI # r** between STX and ETX is recorded on the magnetic stripe under the conditions set using the command 'MSR parameter block' (**CSI ... ! r**). The character string must contain the start and end characters appropriate to the selected recording format:

Format	n3	Start character	End character
DIN	0	3D	3F
IBM 1	1	3B	3C
IBM 2	2	3B	3F
105 characters	5	3D	3F
ISO 7811	6	3B	3F

After the execution of the command a acknowledgement **CSI n1; n2 # r** is produced, which can be evaluated in the program. The acknowledgement contains the number of writing attempts and a message if an error has occurred during control reading.




- In the MSR unit of the document printer, the characters are limited to the range from 30h-3Fh. Characters outside this range lead to an error in the printer control.
- The command triggers the output of characters still in the print buffer to the document printing point.

Deleting a MSR track

CSI		%	r	Name
ESC	[	%	r	ASCII character
27	91	37	114	Decimal
1B	5B	25	72	Hexadecimal

Function:

The vertical position on the magnetic stripe fixed at the transfer of the MSR parameters (**CSI ... ! r**) is overwritten with 'ZERO' characters (the MSR track is deleted).

 The command triggers the output of characters still in the print buffer to the document printing point.

The MICR Read Process

Two jobs must be issued to the printer for every magnetic stripe read process:

- a parameter job specifying the number of repetitions required for read errors, and the font type (CMC7/E13B),
- the actual read command.

The parameter n3 in the parameter job (CMC7 / E13B) informs the firmware that the next MSR read job is a magnetic ink character recognition process. When the MICR process is completed, the previously deactivated MSR parameter is re-enabled.

Behavior when reading magnetic ink characters and passbooks

A mechanism is required to ensure that a passbook is not inserted too far for the magnetic ink character recognition, because the reader's permanent magnet may destroy the MSR recording on the passbook.

Therefore a journal has been defined with a max. settable width (see parameter job MSR / MICR reader) for the MICR read function. The default value is 102mm.



For the MICR read process the parameter n4 has a different meaning than for the other MSR functions:

MSR: n4 = vertical distance from the form edge (in 1/180 inches).

MICR: n4 = max. admissible journal width for magnetic ink character reading

The parameter n4 is used by the application to transfer the max. admissible journal width (cheque width in normal view). If the parameter n4 contains a value below "496" (496/180 inches = 70mm) or a value above "1490" (1490/180 inches = DIN A4 width), then the max. admissible width is automatically set to the default value "725" (725/180 inches = 102mm, specification according to: ISO 1004, ABA Specification, Credit Document and Code Line Dimensions).

If the document inserted for reading the magnetic ink characters is wider than specified, the read process is not started, and the document is not moved. The printer remains in the 'ONLINE PAPER' status, and the normal MSR acknowledgement is sent to the application, together with the error code 8 (max. admissible paper width exceeded). The application controls the subsequent processing of the document.

Example sequence for an MICR reader

Status: NO_PAPER.

- 1 Switch MSR to magnetic ink character recognition (see MSR parameter) without repeating the read process and with 90mm = 638/180 inches (smaller than default value) max. admissible cheque width (Parameter = 0;0;10;638;0):

```
1B 5B 3B 3b 31 30 3B 36 33 38 3B 21 72
```

2. Start magnetic ink character recognition:

```
1B 5B 22 72
```

- Green light is flashing, LCD display: LOAD PAPER.
- Insert document (cheque with magnetic ink).
- The document is drawn in; the width is measured.
- The document width is checked before the read process is started.

3. Response from the printer

- OK with data. (The document is 90 mm wide, or less.):
The document is drawn in further for reading the magnetic ink characters, and guided across the magnetizing and read head.
The read data (d1 ... dn) is packed as for the MSR acknowledgement, and sent to the application:

```
1B 5B 31 3B 3B 3B 22 72 02 d1 d2 d3 ... dn 03
```

- OK without data:
If no characters are recognized, e.g. when the cheque is incorrectly inserted, the read logic issues a blank character between the start and the end character:

```
1B 5B 31 3B 3B 3B 22 72 02 20 03
```

- Ok with data:
All characters read are placed between the start character and the end character, and are sent to the application.
Characters which were not recognized (rejects) are transferred as "?" (= 3F hex.):

1B 5B 31 3B 3B 3B 22 72 02 30 31 32 3F 34 35 ... 39 03

- Not OK (The document is wider than 90mm.):
The document remains in its position (it is not moved).
An MSR acknowledgement is generated (without read data between start and end character), and contains the error code 8 (= ASCII "38") in the parameter byte n4:

1B 5B 3B 3B 3B 38 22 72 02 03

The document can be processed (printed, ejected) without any limitations.

Activate parameter command MICR

CSI		n1;...;n5	!	r	Name
ESC	[	n1;...;n5	!	r	ASCII character
27	91	n1;...;n5	33	114	Decimal
1B	5B	n1;...;n5	21	72	Hexadecimal

Parameter for MICR:

- n1 = 0 (no function, parameter is ignored)
- n2 = Number of reading repetitions (parameter is ignored)
- n3 = Identifier for reading format with:
 - 10 = CMC7
 - 11 = E13B
- n4 = maximum document width (in 1/180) inch
 - adjustable: 496 to 1490 (70mm to 210mm)
 - all other values activate the default value 725 (102mm)
 - Accuracy of measurement: approx +/- 1mm
- n5 = 0 (no function, parameter is ignored)

Reading command MICR

Command:

CSI	"	r	Name	
ESC	[	"	r	ASCII character
27	91	34	114	Decimal
1B	5B	22	72	Hexadecimal

By this command reading is started corresponding to the parameters which have been handed over before. For magnetic ink character reading the corresponding parameter has to be handed over immediately before.

Response:

CSI	n1;...;n4	"	r	STX...ETX	Name	
ESC	[	n1;...;n4	"	r	STX...ETX	ASCII character
27	91	n1;...;n4	34	114	2...3	Decimal
1B	5B	n1;...;n4	22	72	02..03	Hexadecimal

Parameter for MICR:

n1 = Number of reading attempts

n2 = 0

n3 = 0

n4 = Error code:

0 = no error

8 = maximum permissible paper width exceeded

Status and error messages

The CSI sequences described in the following section are either issued by the program and acknowledged with appropriate responses or, depending on the processing situation, are automatically generated by the document printer and transmitted to the processor:

Command	Function	Initiator
ESC [n ! t	Initiating the control cycle	Program
ESC [n) t	Setting control point II	Program
ESC [n ! z	Global printer status	Document printer
ESC [" z	Requesting special printer messages	Program
ESC [n ; m " z	Special printer messages	Document printer
ESC [n # z	Requesting printing unit parameters	Program
ESC [n1 ; ... ; n8 # z	Printing unit parameters	Document printer



The internal message buffer of the document printer is limited to approx. 30 status messages. When this buffer is full, messages subsequently generated are ignored (cleared). For this reason, care must be taken in the application program that the messages are loaded and evaluated at appropriate intervals.

Notes on the printer status

ONLINE

This status exists after an error- free initializing operation. In this status the receiving channel is open. The printer is ready to receive and execute jobs. There is a response only with requested data or special printer messages which have no influence on the current processing of print data.

STOP

This status signals an operation interruption. The following causes lead to this operation interruption:

- Pressing the STOP key in the ONLINE status
- Opening the printing unit in the ONLINE status
- Document request, i. e. a job which requires the insertion of a new form, whereby at this time no sheet is inserted (inserting a new sheet restores the ONLINE status)

In the first two cases, the computer is only informed of the status change via a global printer status (GPS). For document request, the reason for the status change is identified more exactly via a special printer message (SPM).

In each case, the STOP status can only be cleared by means of manual intervention on the printer. No data is lost as a result of these operation interruptions.

ERROR

This status signals an operating termination. It can only be cleared by means of manual intervention on the printer. All jobs not carried out up to the termination are cancelled. There are two groups of errors:

- Hardware errors
The most common cause of the error status is a hardware error. If this error is only restricted to a subfunction of the printer (for example, MSR), it can be ignored by pressing the STOP key. The printing unit is then able to work until an attempt is made to use this defective subfunction again.
- Application errors
Errors of the documents must here be seen as special cases, as such errors are caused by the user himself and can also be eliminated by him. Such a case occurs, for example, if there is an attempt to print or read a document outside its physical limits.

The cause of all errors is shown on the LCD of the document printer (see the “List of error messages” in the appendix of this manual).

'Break' function

The document printer reacts to a 'break' in the printer interface with the transfer of a global printer status and the response 'Printing unit parameters' on the basis of which the key information on the printer configuration can be recognized (see description **CSI n;...; n8 # z**). If the global printer status is ONLINE, the receive buffer is also cleared and the default parameters of the emulation are set.

The 'break' function can be used to check whether the printer connected to the printer interface is switched on and in which status it is at the time.



The 'break' should not be used to query the status during running operation. Status changes are automatically indicated by the document printer.

Setting control points/ initiating the control cycle

Command:

CSI		n	!	t	Name
ESC	[	n	!	t	ASCII character
27	91	n	33	116	Decimal
1B	5B	n	21	74	Hexadecimal

Response (control point):

CSI		n	!	t	Name
ESC	[	n	!	t	ASCII character
27	91	n	33	116	Decimal
1B	5B	n	21	74	Hexadecimal

Parameter:

n = value freely definable by the application in the range 0 to 9999.

Function:

The command **CSI n ! t** triggers the initiation of an acknowledgement signal to the computer interface if all the jobs transferred up to this command have been processed.

For a definite assigning of the acknowledgement signals (also **CSI n ! t**) to the transferred requests, the acknowledgement message contains the same parameter value *n* that the application transferred in the request.



- If possible, the command **CSI n ! t** should be avoided in a transaction as the use of this command can negatively influence the performance of applications. When using **CSI n ! t**, the following notes are important.
- The request for acknowledgements via **CSI n ! t** should only occur at the end of a line or during a function switch-over (for example, from printing to reading MSR). This corresponds to the printer sequencing and does not interfere unnecessarily with the performance of the document printer.
- The optimal printing path (bidirectional printing) is interrupted by means of this command.
- The order of the acknowledgement messages from the document printer is the same as the order of the acknowledgement requests.
- If an application is working with these acknowledgement cycles, it should not wait for the respective acknowledgement signal, but immediately transmit further print data. Subsequently, the response can be evaluated..

Setting control point II

Command:

CSI	n	)	t	Name	
ESC	[	n	)	t	ASCII character
27	91	n	41	116	Decimal
1B	5B	n	29	74	Hexadecimal

Response (control point):

CSI	n	)	t	Name	
ESC	[	n	)	t	ASCII character
27	91	n	41	116	Decimal
1B	5B	n	29	74	Hexadecimal

Parameter:

n = value freely definable by the application in the range 0 to 9999.

Function:

The command **CSI n) t** triggers the release of an acknowledgement signal to the processor interface if the last mechanical procedure was started in the printing unit and no error has occurred at this point in time.

For a definite assigning of the acknowledgement signals (also **CSI n) t**) to the transferred requests, the acknowledgement message contains the same parameter value n that the application transferred in the request.



The command **CSI n) t** should always be used when only one print line can be made available to the printer and for this reason performance problems arise.

The control point is acknowledged when the last mechanical task is started.

For example, a print task is acknowledged when all the conditions for correct execution of the print line are fulfilled, this means:

- Data is transferred;
- Document edges are measured;
- Feeds are executed;
- Paper is present;
- Lid is closed;
- Print procedure is started.

By means of an earlier release of the acknowledgement signal it is possible for the workstation to request a new task from the system earlier and to transfer it to the printer during the time in which the last mechanical procedure has not yet terminated.

Global printer status

CSI		n	!	z	Name
ESC	[	n	!	z	ASCII character
27	91	n	33	122	Decimal
1B	5B	n	21	7A	Hexadecimal

Parameter:

n = 0 ONLINE

n = 1 STOP

n = 2 ERROR

Function:

This response in the coding **CSI n ! z** is produced spontaneously after initializing the printer, after each status change (ONLINE, STOP, ERROR) and after a 'break' on the printer interface.

The global printer status cannot be explicitly requested (see "Notes on the printer status" in this chapter).

Special printer messages

Command (requesting special printer messages):

CSI		"	z	Name
ESC	[	"	z	ASCII character
27	91	34	122	Decimal
1B	5B	22	7A	Hexadecimal

Response (requesting special printer messages):

CSI		n;m	"	z	Name
ESC	[	n;m	"	z	ASCII character
27	91	n;m	34	122	Decimal
1B	5B	n;m	22	7A	Hexadecimal

Parameter:

n = 'Global Code' (0 to 999)

m = 'Special Code' (0 to 999)

Function:

Special printer messages are produced in the following cases and transferred to the system:

- when changing the appropriate statuses
- when using the keys USER 2 or USER 1 via the operator (only if the function 'Dual station control' was activated using the command **CSI n * t**)

Further, the current status can be requested using the command **CSI " z**.

The following n/m combinations for the encryption of a special printer message are possible:

PAPER	n = 1 / m = 4	The paper sensor on the document printing point is covered with paper again.
NO PAPER	n = 2 / m = 4	The paper sensor on the document printing point is no longer covered with paper.
USER 1 key	n = 20 / m = 1	The USER 1 key on the operating panel was pressed. This printer message can only occur if the function 'Dual station control' was activated using the command CSI n * t .
USER 2 key	n = 20 / m = 2	The USER 2 key on the operating panel was pressed. This printer message can only occur if the function 'Dual station control' was activated using the command CSI n * t .

Printing unit parameters

Command (requesting printing unit parameters):

CSI		n	#	z	Name
ESC	[	n	#	z	ASCII character
27	91	n	35	122	Decimal
1B	5B	n	23	7A	Hexadecimal

n = 0 Response without parameter n8 (printer type)

n = 1 Response with parameter n8 (printer type)

Response (printing unit parameters):

CSI		n1;...;n9	#	z	Name
ESC	[	n1;...;n9	#	z	ASCII character
27	91	n1;...;n9	35	122	Decimal
1B	5B	n1;...;n9	23	7A	Hexadecimal

Parameter:

n1 = Printing station number

0: document station

1: journal station

n2 = 4: document

n3 = maximum width of form in 1/10 inch

n4 = number of feed channels

2: feeder option

n5 = Number of eject channels

n6 = 0: OCR reader option not available

1: MICR reader option

n7 = MSR option

0: option not available

1: option available

n8 = printer type

n= 9 Memory Extension
0: No Memory Extension
1: El. Journal
2: 2. CG
3: Asien GB 2312
4: Asien GB 5007
5: Asien GB 5199
6: Asien GB BIG 5

Parameter message with el. journal:

n1 = Printer station number
0: document station
1: journal station
n2 = 3: journal
n3 = maximum width of form 1/10 inch
n4 = Number of feed channels
n5 = Number of eject channels
n6 = OCR reader option not available
n7 = MSR option
n8 = printer type
n9 = Memory Extension
1: El. Journal

Function:

In the following cases the response of the printing unit parameters will be transferred from the printing unit to the system:

- after switching on the printing unit;
- as response to a 'Break' at the printer interface;
- as response to the command 'Requesting printing unit parameters'.

Electronic Journal Functions

Change between Document and Journal Printing

CSI		n	!	q	Name
ESC	[	n	!	q	ASCII character
27	91	n	33	113	Decimal
1B	5B	n	21	98	Hexadecimal

Parameter:

n = 0 Document print (Default)

n = 1 Electronic journal memory

The parameter 'Journal memory' is used to redirect all following print characters to a resident memory. All control sequences are ignored, except for line feeds. This command initializes the printout of all characters still located in the internal print buffer.

Command sequences which are written into the journal memory have no influence to the printout off the document station:

This function is available only in the device variant with 'memory extension'. The selection Memory Extension -> EL-Journal must be enabled from the Service menu. If the selection is not enabled, the command will be ignored

.

i When the electronic journal memory is enabled, only the net data (printable characters) is stored. Any attributes, tabs, character set commands are filtered from the data stream. Graphic data is not supported.

In this mode, the responses are extended.

Journal printing

The data in the journal memory can be printed on the print station using the JOURNAL menu (single sheet or feeder).

- The DIN-A4 format is always used for the printout.
- Font attribute DQ 15 cpi, 8 lpi.
- Font attributes are always ignored.

An unprintable margin of 2 cm is provided on each side of the journal for filing holes. An identifier for the page numbers and a hint on the following pages (e.g. Page 5 of 17) are printed on the bottom of each page.

Error situation exception handling

When the printer is switched off while printing the journal data, or a print error occurs, the data is not lost, but the complete print process must be repeated.

When the memory is filled by approx. 95%, the status message 'End-of-paper journal' is generated.

When the journal memory is filled completely, the error message 'End-of-paper journal' is generated. Any subsequent attempt to print data on the journal will be rejected with the same error message. Print jobs can still be carried out on the document station.

Capacity

Because the print data is stored in compressed form, it is not possible to provide an exact specification of the memory behavior. In typical applications, a capacity of 3,000 to 6,000 print lines can be achieved.

Technical data - memory:

- 128 KB usable memory volume.
- 10 years guaranteed data retention without power supply.
- 100,000 guaranteed delete/programming cycles.
- Partial deletion of data not possible.

Application examples

This chapter demonstrates using detailed examples how the document printer is programmed for common application cases.

In particular, the following application cases will be explained in separate sections:

- Text processing (printing on a blank form using different print attributes)
- Document processing (printing a specimen cheque)
- Passbook processing with MSR (reading and modifying a MSR stripe and passbook printing)

Normally each example consists of the following components:

- Task description/target
- Document description (document size, text area)
- Assumed pre-conditions (for example, preset parameters)
- Verbal description of the program steps
- Conversion of the program steps into pseudo code
- Program result.

Processing of a blank form

In the following example, a DIN A4 document will be printed with defined text. To structure the layout and to highlight important parts of the text, standard commands for print attributes, horizontal and vertical tabulation will be used. All the print data relates logically to the left leading edge so that a conversion of the print positions of the document to print positions of the printing unit need not be taken into account.

For this example the following pre-conditions are assumed:

- All the parameters are set at their default values
- Via the default setting the type font “Roman” is set.

- 1 : Document length = 72 lines with 1/ 6 inch line spacing
- 2 : First print position = left margin (logical) = position 12 (10 cpi)
- 3 : Last print position = right margin (logical) = position 72 (10 cpi)
- 4 : Position of processor ab- = 35 (horizontal tab)
breviation
- 5 : Position of date = 40 (horizontal tab)
- 6 : First print line = 8 (vertical tab)
- 7 : Reference line = 16 (vertical tab)
- 8 : Start of text = 20 (vertical tab)
- 9 : Greetings line = 42 (vertical tab)
- 10: Name of sender = 46 (vertical tab)

Print effects

Mr. Specimen
7, Princes Road
London. W.5

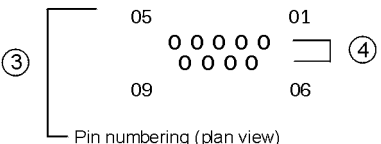
js 14.06.99

RS – 232 – interface ①

Dear Mr. Specimen, ②

herewith we would like to answer your query about the type of **connector for the RS–232 interface** of the printer.

For the RS–232 interface the printer has a 9-pin Cannon plug.



③ Pin numbering (plan view) ④

Yours sincerely

(John Smith)

General

- Character size = 10 cpi
- Type font = Roman

Specialities

- 1 : Reference line in italics and additional line spacing of 12/180 inch
- 2 : Part of text 'connector for the RS-232 interface' highlighted with bold print
- 3 : Type font for sketch = Sans Serif, text centred
- 4 : For the illustration of the pins (small 'o') the following conditions apply:
 - no proportional spacing
 - character size 15 cpi
 - additional character spacing between small 'o' = 24/180 inch

Program steps (annotated)

1. Switching on LQ mode
Command: ESC x (n)
Parameter: n = 1 (LQ mode)

2. Switching on proportional spacing
Command: ESC p (n)
Parameter: n = 1 (proportional spacing on)
Remarks: With proportional spacing setting the character width is unnecessary.

3. Setting line spacing
Command: ESC 2 (1/6 inch)
Remarks: This command is not actually necessary for the example as 1/6 inch line spacing is the default value.

4. Determining the document length
Command: ESC C (n)
Parameter: n = 72 (number of lines)
Remarks: With line spacing of 1/6 inch and 72 lines, a document length of 12 inches results. This corresponds to the default value of the document printer. Therefore this program step could also be omitted.

5. Determining the left margin
Command: ESC l (n)
Parameter: n = 12 (position 12 with 10 cpi, default = 0)

6. Determining the right margin

Command: ESC Q (n)
Parameter: n = 72 (position 72 with 10 cpi)
Remarks: The default value is 90. With a setting 'right margin = position 72' printing is possible up to position 71.

7. Determining the vertical tabs

Command: ESC B (n1,n2,n3,n4, n5) NUL
Parameters: n1 = 8 (first print line)
n2 = 16 (reference line)
n3 = 20 (start of text)
n4 = 42 (greetings line)
n5 = 46 (name of sender)
Remarks: Here the vertical tabs in a line spacing of 1/6 inch are automatically determined in channel 0. For channel 1 to channel 7 the command ESC c (n1,...) NUL must be used (c = channel number).

8. Deleting the default values for horizontal tabs

Command: ESC D NUL
Remarks: After switching on or initializing the printer (ESC @) tabs are set at a spacing of eight (8) characters.

9. Setting the horizontal tabs

Command: ESC D (n1,n2) NUL
Parameters: n1 = 35 (position of processor abbreviation)
n2 = 40 (position of date)
Remarks: In proportional printing the characters are set in pica spacing (10 cpi).

10. Vertical tabulation to the first address line
Command: VT

11. Printing address
Remarks: Last address line (place) without line feed

12. Horizontal tabulation to the processor abbreviation
Command: HT

13. Printing processor abbreviation
Remarks: Printing without line feed

14. Horizontal tabulation to the date
Command: HT

15. Printing date

16. Vertical tabulation to the reference line
Command: VT

17. Setting italic print
Command: ESC 4

18. Determining additional spacing between characters

Command: ESC SP (n)

Parameter: n = 12

Remarks: SP = space stands for the blank space (ASCII = hex 20 or decimal 32 and EBCDIC = hex 40 or decimal 64). Via n = 12 in LQ mode, an additional character spacing of 12/180 inch is determined. In draft mode this would be 12/120 inch.

19. Printing reference line

20. Deleting additional spacing between the characters

Command: ESC SP (n)

Parameter: n = 0 (Default value)

21. Switching off italic print

Command: ESC 5

22. Vertical tabulation to start of text

Command: VT

23. Printing text from 'Dear Mr ...' to '... query about the type of'

24. Switching on bold print

Command: ESC E

25. Printing text 'connector for the RS- 232 interface'

26. Switching off bold print

Command: ESC F

27. Printing text to '... 9- pin Cannon plug' plus blank lines to sketch

28. Selecting other LQ type

Command: ESC k (n)

Parameter: n = 1 (Sans Serif)

29. Setting centred print format adjustmentext

Command: ESC a (n)

Parameter: n = 1

30. Printing '05 ... 01'

31. Switching off proportional spacing

Command: ESC p (n)

Parameter: n = 0 (Default value)

32. Setting character size to 15 cpi

Command: ESC g

33. Determining additional spacing between characters

Command: ESC SP (n)

Parameter: n = 24

Remarks: Additional spacing = 24/180 inch, see also step 18.

34. Printing lines with 'oo ... oo' (5 times) and 'oo ... oo' (4 times)

35. Deleting additional spacing between characters

Command: ESC SP (n)

Parameter: n = 0

36. Setting character size to 10 cpi again

Command: ESC P

37. Switching proportional spacing on again

Command: ESC p (n)

Parameter: n = 1

38. Printing from '09 ... 06' to 'Pin numbering (plan view)'

39. Setting print format adjustment to flush left again")

Command: ESC a (n)

Parameter: n = 0 (default value)

40. Changing type font

Command: ESC k (n)

Parameter: n = 0 (Roman)

41. Vertical tabulation to the greetings line

Command: VT

42. Printing greetings line

43. Vertical tabulation to the name of sender

Command: VT

44. Printing name of sender

45. Document ejection

Command: FF

Program (pseudo code)

The corresponding numbering refers to the annotated program steps in the previous section.

```
BEGIN
  CALL PROGRAM START ROUTINE
  CALL LETTER HEAD
  CALL REFERENCE
  CALL INTRODUCTION
  CALL SKETCH
  CALL SENDER
  PRINT(char(12))
END
```

45: FF

```
BEGIN PROGRAM START ROUTINE
  PRINT(char(27), "x", char(1))
  PRINT(char(27), "p", char(1))
  PRINT(char(27), "2")
  PRINT(char(27), "C", char(72))
  PRINT(char(27), "l", char(12))
  PRINT(char(27), "Q", char(72))
  PRINT(char(27), "B")
  PRINT(char(8,16,20,42,46),
        char(0))
  PRINT(char(27), "D", char(0))
  PRINT(char(27), "D")
  PRINT(char(35,40), char(0))
END PROGRAM START ROUTINE
```

1: ESC x (n)

2: ESC p (n)

3: ESC 2

4: ESC C (n)

5: ESC l (n)

6: ESC Q (n)

7: ESC B (n1...) NUL

8: ESC D NUL

9: ESC D (n1...) NUL

BEGIN LETTER HEAD	
PRINT(char(11))	10: VT (line 8)
PRINTLF(Mr. Specimen"))	11:
PRINTLF("7,Princes Road,"))	
PRINTLF()	
PRINT("London. W. 5.")	
PRINT(char(9))	12: HT (position 35)
PRINT("js")	13:
PRINT(char(9))	14: HT (position 40)
PRINTLF("14.06.99")	15:
END LETTER HEAD	
BEGIN REFERENCE	
PRINT(char(11))	16: VT (line 16)
PRINT(char(27),"4")	17: ESC 4
PRINT(char(27)," ",char(12))	18: ESC SP (n)
PRINT("RS-232-interface")	19:
PRINT(char(27)," ",char(0))	20: ESC SP (n)
PRINT(char(27),"5")	21: ESC 5
END REFERENCE	

```
BEGIN INTRODUCTION
PRINT(char(11))
PRINT("Dear Mr. Specimen,")
PRINTLF( )
PRINT(" herewith we should like to
      answer your query about
      the type of")
PRINT(char(27),"E")
PRINT("connector for the
      RS-232 interface")
PRINT(char(27),"F")
PRINTLF("of the printer.")
PRINTLF( )
PRINTLF("For the RS-232 interface
      the printer has
      a 9-pin Cannon plug:")
PRINTLF( )
END INTRODUCTION
```

22: VT (line 20)

23:

24: ESC E

25:

26: ESC F

27:

BEGIN SKETCH	
PRINT(char(27), "k", char(1))	28: ESC k (n)
PRINT(char(27), "a", char(1))	29: ESC a (n)
PRINTLF("05 ... 01")	30:
PRINT(char(27), "p", char(0))	31: ESC p (n)
PRINT(char(27), "g")	32: ESC g
PRINT(char(27), " ", char(24))	33: ESC SP (n)
PRINTLF(" ooooo")	34:
PRINTLF(" oooo")	
PRINT(char(27), " ", char(0))	35: ESC SP (n)
PRINT(char(27), "P")	36: ESC P
PRINT(char(27), "p", char(1))	37: ESC p (n)
PRINTLF("09 ... 06")	38:
PRINTLF()	
PRINTLF("Pin numbering (plan view)")	
PRINT(char(27), "a", char(0))	39: ESC a (n)
PRINT(char(27), "k", char(0))	40: ESC k (n)
END SKETCH	
BEGIN SENDER	
PRINT(char(11))	41: VT (line 42)
PRINTLF("Yours sincerely")	42:
PRINTLF(char(11))	43: (line 46)
PRINTLF("(John Smith)")	44:
END SENDER	

Document processing

This example is to illustrate document processing with the following features:

- Coding the coding line
- Printing a text on the document.

This example is based on producing a specimen cheque. The coding line on the cheque is to be processed with bottom reference, the text on the cheque with top reference.

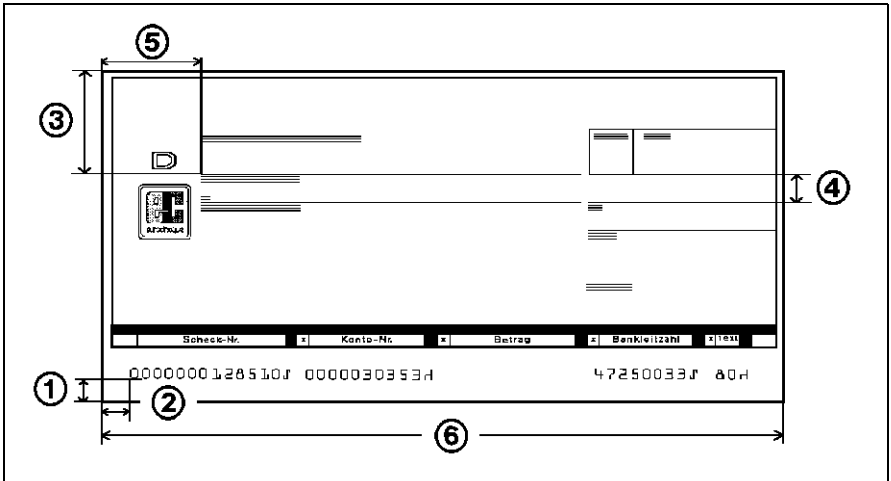
The following pre-conditions are assumed:

- The document printing point is activated
- Passbook processing is deactivated
- Character set OCR-A is set
- Specification of the horizontal leading edge on the left (default)



- In this example, document width detection is requested explicitly. The restrictions for document width detection with regard to the current vertical position must be taken into account for this.
- In this example, no horizontal tabs are set, but the respective print position is determined in a horizontal direction by means of an absolute dot position (**ESC \$ (n) (m)**).

Document structure

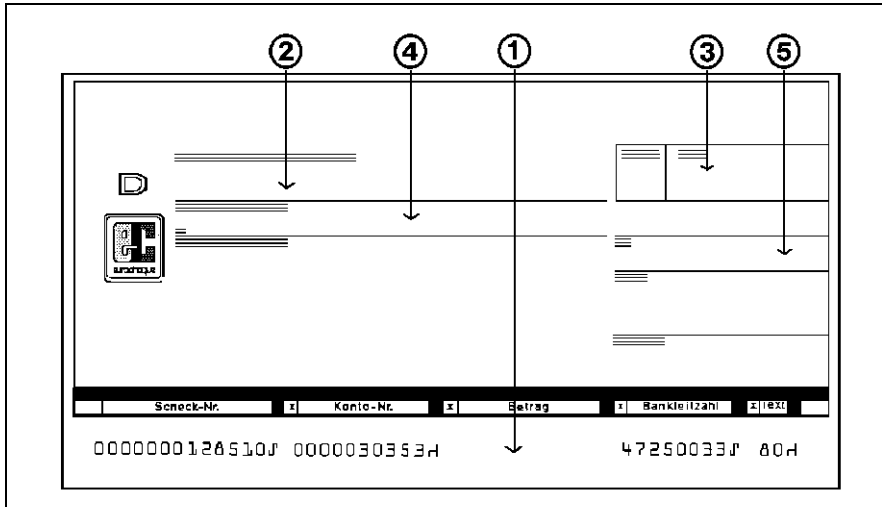


- 1 : Distance bottom edge of document/ bottom edge of coding line
= 8.47 mm = 60/180 inch (DIN 66008)
- 2 : Distance left edge of document/ left edge of first OCR A character
= 3/10 inch (DIN 66008) \equiv print position 3 (with 1/10 inch/character)
- 3 : Distance top edge of document/ bottom edge of first text line
= 24 mm = 170/180 inch
- 4 : Distance between the text lines = 7.5 mm = 53/180 inch
- 5 : Distance left edge of document/ left edge of first print character
= 10/10 inch \equiv print position 10 (with 1/10 inch/character)
- 6 : Document width = 59/10 inch

The character density in a text line is to be 10 characters/ inch (default value).

Print positions

The following illustration shows the different print positions for text and OCR printing:



An absolute dot position on the respective current vertical position is reached via the command **ESC \$ (n) (m)**. The position is calculated with the formula $x = m * 256 + n$ and thereby the position $x/60$ inch (= distance from left leading edge) is determined. The print position 0 is identical with the left edge of the document.

- 1 : OCR print in coding line for cheque amount
 Vertical position from bottom edge = 60/180 inch
 Absolute dot position = $x/60$ inch with $x = 0 * 256 + 180$
 (First print character on print position 30)
 OCR character sequence = "00000045000 "
- 2 : Amount text
 Vertical position from top edge = 170/180 inch
 Absolute dot position = $x/60$ inch with $x = 0 * 256 + 60$
 (First print character on print position 10)
 Text= "FOUR HUNDRED AND FIFTY-----"

- 3 : Currency abbreviation and amount
 Vertical position from top edge = 170/180 inch
 Absolute dot position = $x/60$ inch with $x = 1 * 256 + 2$
 (First print character on print position 43)
- 4 : Name
 Vertical position from top edge via line feed of 53/180 inch
 Absolute dot position as 2
 Text "MR. SPECIMEN"
- 5 : Place/ date
 Vertical position from top edge as 4 or another line feed
 Absolute dot position as 3
 Text "LONDON" and "05- 11- 1999"

Program steps (annotated)

1. Setting absolute vertical position referring to the bottom document edge

Command: CSI n " p
Parameter: n = 90
Remarks: The distance bottom edge of document/
bottom edge of OCR line = 90/180 inch
= 12.7 mm was selected in order to have a
sufficient distance to a possibly present
black bar. If such black bars are not there,
you can begin directly with step 2b (see also
the command description CSI " t,
'Requesting the document width', in the
"Additional commands" chapter).

- 2a. Requesting document width (optional)

Command: CSI " t
Remarks: The document width can be used as a
differentiation feature to branch to different
document-dependent application programs.
CSI " t initiates a document request if a
document is not yet present or inserted. The
document request is indicated by the
flashing 'DOCUMENT' LED on the operating
panel.

- 2b. Positioning on the coding line if document width measurement was
used (optional).

Command: CSI n " p
Parameter: n = 60
Remarks: Distance bottom edge of document/bottom
edge of OCR line = 60/180 inch = 8.47 mm

3. Evaluating response to document width
 - Command: CSI (n) " t
 - Parameter: n = 1062
 - Remarks: Document width = $1062/180$ inch = 150 mm
(compare description of the document structure)

4. Reaching horizontal print position for OCR printing
 - Command: ESC \$ (n) (m) = absolute dot position
 - Parameters: n = 180, m = 0
 - Remarks: First print character on position 30 = $180/60$ inch

5. OCR print in amount field
 - Print data: e. g. "00000045000

6. Setting absolute vertical position referring to the top document edge
 - Command: CSI n ! p
 - Parameter: n = 170
 - Remarks: Distance top edge of document/bottom edge of line = $170/180$ inch = 24 mm

7. Reaching horizontal print position for amount text
 - Command: ESC \$ (n) (m) = absolute dot position
 - Parameters: n = 60, m = 0
 - Remarks: First print character on position 10 = $60/60$ inch

8a. Selecting LQ type font

Command: ESC k (n)
Parameter: n = 0 (Roman type font)

8b. Printing amount text

Print data: "FOUR HUNDRED AND FIFTY-----"

9. Reaching horizontal print position for currency abbreviation/amount
= 24 mm

Command: ESC \$ (n) (m)
Parameters: n = 2, m = 1
Remarks: First print character on position 43 = 258/60
inch

10. Printing currency abbreviation/ amount

Print data: "£ ---- 450,00"

11. Line feed

Command: ESC J (n)
Parameter: n = 53
Remarks: ESC J (n) executes a line feed of n/180 inch,
here 53/180 inch = 7.5 mm.

12. Reaching horizontal print position for name of receiver

Command: ESC \$ (n) (m)
Parameters: n = 60, m = 0 (see also step 9)

13. Printing name of receiver

Print data: for example, "MR. SPECIMEN"

14. Reaching horizontal print position for place name

Command: ESC \$ (n) (m)

Parameters: n = 2, m = 1 (see also step 11)

15. Printing place name

Print data: for example, "LONDON"

16. Line feed

Command: ESC J (n)

Parameter: n = 53 (see also step 13)

17. Reaching horizontal print position for date

Command: ESC \$ (n) (m)

Parameters: n = 2, m = 1 (see also step 16)

18. Printing date

Print data: for example, "05- 11- 1999"

19. Document ejection

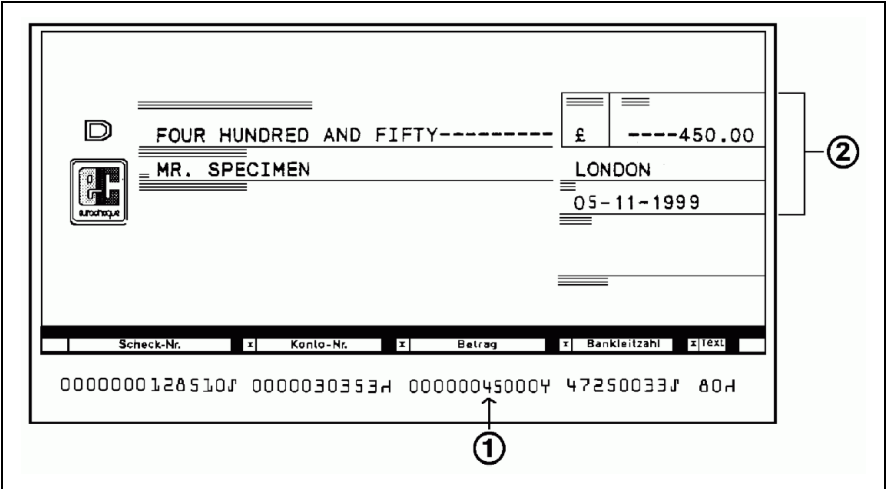
Command: FF (Form Feed)

Program (pseudo code)

The corresponding numbering refers to the annotated program steps in the previous section.

BEGIN	
PRINT(char(27), "[90"p")	1: CSI n"p
PRINT(char(27), "["t")	2a: CSI"t
PRINT(char(27), "[60"p")	2b: CSI n"p
GET(char(27), "[", char(n), "t")	3: CSI (n)"t
.	
.	
If necessary, evaluate the parameter n (document width in n/180 inch)	
.	
.	
CALL OCR LINE	
CALL TEXT PRINTING	
PRINT(char(12))	19: FF
END	
 BEGIN OCR LINE	
PRINT(char(27), "\$", char(180,0))	4: ESC \$ (n) (m)
PRINT("00000045000 ")	7:
END OCR LINE	
 BEGIN TEXT PRINTING	
PRINT(char(27), "[170!p")	6: CSI n! p
PRINT(char(27), "\$", char(60,0))	7: ESC \$ (n) (m)
PRINT(char(27), "k", char(0))	8a: ESC k (n)
PRINT("FOUR HUNDRED AND FIFTY -----")	8b:
PRINT(char(27), "\$", char(2,1))	9: ESC \$ (n) (m)
PRINT("£ ---- 450,00")	10:
PRINT(char(27), "J", char(53))	11: ESC J (n)
PRINT(char(27), "\$", char(60,0))	12: ESC \$ (n) (m)
PRINT("MR. SPECIMEN")	13:
PRINT(char(27), "\$", char(2,1))	14: ESC \$ (n) (m)
PRINT("LONDON")	15:
PRINT(char(27), "J", char(53))	16: ESC J (n)
PRINT(char(27), "\$", char(2,1))	17: ESC \$ (n) (m)
PRINT("05-11-1999")	18:
END TEXT PRINTING	

Result:



- 1 : Result from OCR LINE
- 2 : Result from TEXT PRINTING

Passbook processing with MSR

This example illustrates programming for passbook processing with MSR. The passbook is to be positioned on the magnetic stripe with bottom reference. Then the magnetic stripe is read via the MSR device and the data (here line, account, balance) is transferred to the computer. After evaluation of the read data, the magnetic stripe is to be written with new MSR data and the passbook positioned on the next free posting line. After evaluation of the result 'writing MSR', the posting line is edited and printed.

The following pre-conditions are assumed:

- Character font with LQ quality is set
- Specification of the horizontal leading edge on the right.

Passbook data

Name, Address			Account Number		
John Smith 123 High Street London E C2P 2AH			01234500471		
Line—Signature	Date	Description	Serial No.	Withdrawals/Receipts	Balance
1	07-01-99	Balance	021	*500.00	***500.00
2	07-01-99	Cash	022	*1,300.00	***1,800.00
3	07-03-99	Payment	023	*200.00	***1,600.00
4	07-04-99	Payment	024	*100.00	***1,500.00
5	07-10-99	Payment	025	*150.00	***1,350.00
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
					3

- 1 : Passbook width 209 mm
- 2 : Distance bottom edge of posting line 1/ top edge of passbook = 34 mm = 241/180 inch
- 3 : Line spacing between the posting lines = 1/5 inch
- 4 : Number of posting lines = 20
- 5 : Five posting lines present
- 6 : Printable area in a posting line = positions 25 to 86 (print positions of the printing unit for 10 cpi)
print position 90 is identical with the right edge of the passbook.

MSR processing is as per DIN.

Program steps (annotated)

1. Setting MSR parameters

Command: CSI n1; n2; n3; n4; n5 ! r
Parameters: n1 = 0 (no write repetitions = default value)
n2 = 0 (no read repetitions = default value)
n3 = 0 (write/read format = DIN)
n4 = 99 (vertical distance from leading edge =
99/ 180 inch = 14 mm)
n5 = 1 (bottom leading edge)
Remarks: This parameter combination corresponds to
the default setting of the document printer
for MSR processing. Therefore, this program
step could be omitted, if previously another
parameter setting was not selected.

2. Specifying the horizontal leading edge (logical)

Command: CSI n % t
Parameter: n = 1 (form guidance on right)
Remarks: This program step is only relevant if 'left
leading edge' mode is set as default.

3. Reading the magnetic stripe (MSR data)

Command: CSI " r
Remarks: If the passbook is not inserted and drawn in,
this command initiates a document request
(READY LED on the operating panel flashes).

4. Waiting for response 'read MSR' and evaluation of the MSR data
- Response: CSI n1; n2; n3; n4 " r
 STX read data ETX
- Parameters: n1 = number of reading attempts
 n2 = reading threshold
 n3 = reading block number
 n4 = reading error (0 = without error)
- Remarks: When the execution of the command CSI " r
 is without error, the read data contains the
 value for the next free posting line (= 6, see
 step 7).
- Note: The boundary characters STX (hex 02) and
 ETX (hex 03) are also transferred.
5. Updating the magnetic stripe (MSR data)
- Command: CSI # r STX write data ETX
- Parameter: New free posting line = 7, account number
 (unchanged) and new passbook contents
 (balance) depending on deposit or
 withdrawal amount. The write data is
 enclosed between STX (hex 02) and ETX
 (hex 03).
- Remarks: This MSR write command produces an
 acknowledgement in the form of
 CSI n1; n2 # r, which is not evaluated in this
 program example (n1 = number of writing
 attempts needed; n2 = error identification for
 read after write check).

6. Setting absolute vertical position with reference to the top passbook edge (depending on the next free posting line)
- Command: CSI n ! p
Parameter: n = 421 (see remarks)
Remarks: – Next free posting line = 6
– Line spacing = 1/5 inch = 36/180 inch
– Distance bottom edge of posting line 1/ top edge of passbook = 241/180 inch
→ $n = 241 + 36 * (6 - 1) = 241 + 180 = 421$
→ Absolute vertical position = 421/180 inch from top passbook edge
7. Reaching horizontal print position for beginning of posting line
- Command: ESC \$ (n) (m)
Parameter: n = 150, m = 0
Remarks: The position of the right passbook edge corresponds to position 90 of the printing unit (with 10 characters/inch).
→ Position 25 = 25 positions à 6/60 inch
→ $n = 25 * 6 = 150$
8. – Execution of transaction- relevant program steps (for example, modifying passbook file)
– Editing the print data
9. Printing posting line
- Print data: for example "07- 12- 99 Cash 026 "
" * 200. 00 *** 1, 550.00"
10. Document feed = passbook ejection
- Command: FF (Form Feed)

Program (pseudo code)

The corresponding numbering refers to the annotated program steps in the previous section. .

BEGIN	
CALL PROGRAM START ROUTINE	
CALL MSR	
CALL POSTING	
PRINT (char(12))	11: FF
END	
BEGIN PROGRAM START ROUTINE	
PRINT(char(27), "[")	1: CSI n1;...; n5 ! r
PRINT("0;0;0;99;1!r")	1:
PRINT(char(27), "[1%t")	2: CSI n % t
END PROGRAM START ROUTINE	
BEGIN MSR	3: CSI " r
PRINT(char(27), "["r")	4: CSI(...)r
GET(char(27), "[")	STX...ETX
GET(char(n1,59,n2,59,n3,59,n4)	4:
GET(" "r")	4:
GET(char(2)"... MSR data...",	4:
char(3))	
.	
.	
Updating/ processing MSR data	
.	
.	
PRINT(char(27), "[#r")	5: CSI # r STX... ETX
PRINT(char(2), "...new MSR	5:
data...", char(3))	
END MSR	


```

BEGIN POSTING
PRINT(char(27),"[42!p")
PRINT(char(27),"$",char(150,0))
.
.
    Internal processing and editing
    of the print data
.
.
PRINT("...Data in posting line...")
END POSTING
    
```

6: CSI n ! p
 7: ESC \$ (n) (m)
 8:
 9:

Result:

Name, Address		Account Number			
John Smith 123 High Street London EC2P 2AH		01234500471			
Line—Signature	Date	Description	Serial No.	Withdrawals/Receipts	Balance
1	07-01-99	Balance	021	*500.00	***500.00
2	07-01-99	Cash	022	*1,300.00	***1,800.00
3	07-03-99	Payment	023	*200.00	***1,600.00
4	07-04-99	Payment	024	*100.00	***1,500.00
5	07-10-99	Payment	025	*150.00	***1,350.00
6	07-12-99	Cash	026	*200.00	***1,550.00
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
					3

1 : New passbook entry

Loadable Firmware/Character Generators

The firmware and character generators of the passbook and document printer are stored in a programmable memory with FLASH technology. The function for loading this memory is implemented by a resident program (bootstrap loader). The load function is activated either by control sequences in one of the printer emulations or by simultaneously pressing the key combination USER 2 and STOP when the printer is switched on.

The printer cannot be operated when the load mode is running.

- The menu settings are not available.
- The interface functionality is limited to the control functions for the bootstrap loader.

The loader program can be exited by

- Switching off the printer.
- Entering a control sequence after the firmware and the character generator have been loaded successfully.

The functionality is available on the physical interface RS 232, Centronics interface card, and on the 'LAN interface'.

Activating the Load Function

The activation of the load function is done via the printer emulation. The printer is switched to the load mode by entering a specific control sequence.

This control sequence is identical for all emulations.

ESC	BEL	L	n	ASCII chars
27	7	76	48-55	Decimal
1B	07	4C	30-37	Hexadecimal

Function:

This command is used to exit the current emulation software. All data is deleted from the input buffers. The mechanical functions are stopped immediately.

The load software is started, and generates the acknowledgment **ESC BEL L** after 500ms min. for synchronization.

Special features of the RS 232 interface:

The data transfer rate on the RS 232 interface is normally set to 9,600 baud. In the print mode, the maximum rate is 19,200 baud. A temporary increase in the transfer rate is possible in the load mode to reduce the load times.

Parameters

- n = 0 Transfer rate unchanged
- n = 1 Baud rate 2,400
- n = 2 Baud rate 4,800
- n = 3 Baud rate 9,600
- n = 4 Baud rate 19,200
- n = 5 Baud rate 38,400
- n = 6 Baud rate 57,600
- n = 7 Baud rate 115,200

Load Functions: General

The firmware and character generators can be transferred to the passbook and document printer using the interface.

Reasons for a transfer can be:

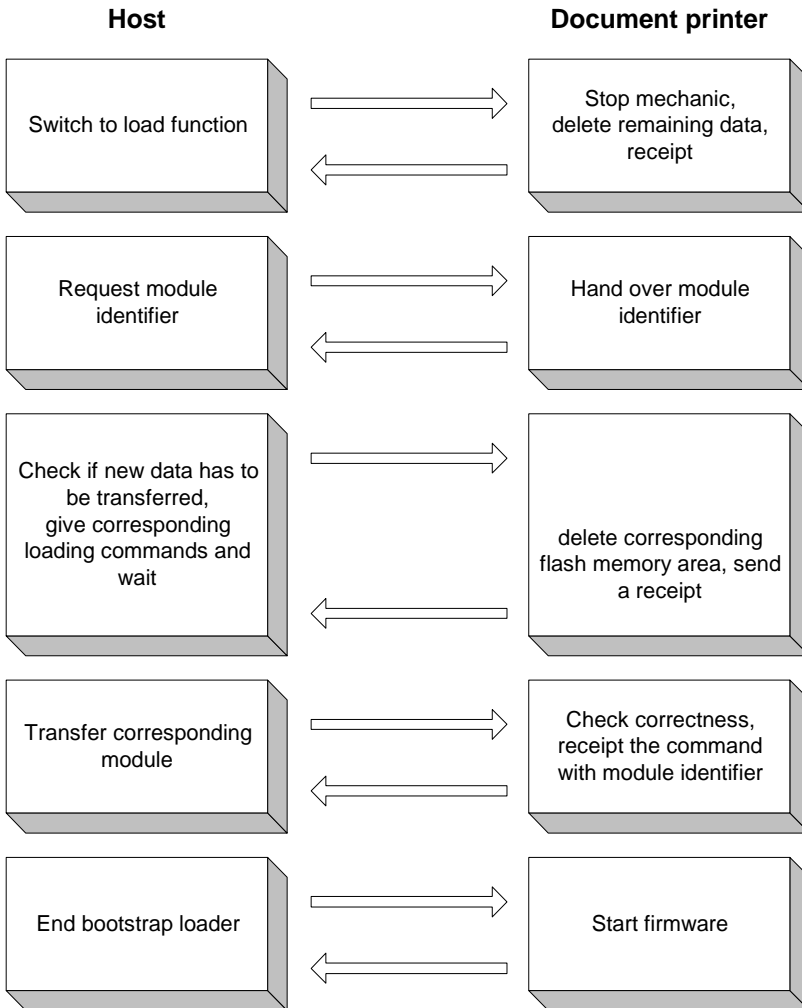
- Initial operation (production).
- Installation of new electronics (i.g. for service).
- Loading a firmware update.
- Loading a national character generator.

The following functions are available in load mode:

- Request module IDs.
- Load character generator I.
- Load character generator II.
- Load firmware.
- Enable printer.

Sequence of a Load Process

The following figure illustrates the sequence of a load process. The order **must** be maintained.



The load process is identical for all data to be loaded. A process begins with the request for the data ID using the escape sequence **ESC I D**. This indicates whether modules are loaded and which version is available.

If the relevant module has not been loaded or if the versions do not match, the appropriate pre-command will be transferred in the second step.

Then the appropriate module can be transferred.

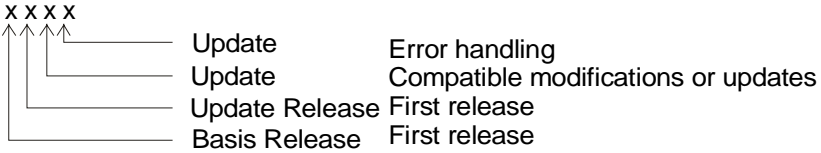
After the completion of the load process the complete file ID is transferred as an acknowledgment. This indicates whether the new module has been transferred correctly.

Module Identification

Every loadable data file can be identified by an ID. The file ID has the following structure:

Length	Contents	Meaning
5	\$xxx\$	Identifier \$MOD\$
1	blank	Separator
6	yymmdd	Release date in the format YYMMDD (941101 for 1.11.94)
1	blank	Separator
4	xxxx	Version ID of the release (0105 for V01.05)
1	blank	Separator
8	a..a	Module name (e.g. "5023_STD", "CP15_437")
1	.	Separator (point)
3	a.a	Extension (MOD, FRM, FNT)
1	: or ;	Separator ":" or end character ";"

Version ID:



Extension

The passbook and document printer contains various data modules. The type of the relevant data module is identified by the file extension. The following table provided a description of the extensions and their meanings:

Extension	Meaning
*.FNT	Font
*.MOD	Firmware
*.FRM	Bootstrap loader (resident, not loadable)
*.TBF	Two-byte font (China)

ESCAPE Sequences (Bootstrap Loader)

Switch-over to the Load Function

ESC	BEL	L	n	ASCII characters
27	7	76	48-55	Decimal
1B	07	4C	30-37	Hexadecimal

Function:

This command is used to exit the currently running emulation software. All data is deleted from the input buffer. The mechanical functions are stopped immediately.

The load software is started and generates the acknowledgment **ESC BEL L** after 500ms min. for synchronization.

Parameters

- n = 0 Transfer rate not changed
- n = 1 Baud rate 2,400
- n = 2 Baud rate 4,800
- n = 3 Baud rate 9,600
- n = 4 Baud rate 19,200
- n = 5 Baud rate 38,400
- n = 6 Baud rate 57,600
- n = 7 Baud rate 115,200

Exiting the Load Function

ESC	BEL	E	ASCII characters
27	7	69	Decimal
1B	07	45	Hexadecimal

Function:

This command is used to exit the bootstrap loader, to test the electronics, and to start the loaded firmware.

Note:

The bootstrap loader is not exited unless a valid firmware and one of the character generators has been loaded.

The firmware returns to the operation with the interface parameters which can be set via the operating panel.

Request Module ID/Data ID

ESC	I	D	ASCII characters
27	73	68	Decimal
1B	49	44	Hexadecimal

Function:

This command is used to request the data ID. All data modules loaded are reported.

Structure of the Data ID

The response always begins with **ESC I D**:

Length	Contents	Meaning
1	ESC	ESCAPE
1	I	Information
1	D	Data ID

Depending on the number of modules loaded, the ID then contains 1 to 4 entries. Each entry has a fixed length and ends with a colon, except for the last entry which ends with a semicolon. The following table shows the structure of an entry:

Length	Contents	Meaning
5	\$xxx\$	Identifier \$MOD\$
1	blank	Separator
6	yymmdd	Release date with the format YYMMDD (941101 for 1.11.94)
1	blank	Separator
4	xxxx	Version ID of the release (0105 for V01.05)
1	blank	Separator
8	a..a	Module name (e.g. "5023_STD", "CP15_437")
1	.	Separator (point)
3	a.a	Extension (MOD, FRM, FNT)
1	: or ;	Separator ":" or end character ";

Examples

Response if only the bootstrap loader is available

```
ESC ID
  $MOD$ yymmdd rrvv BOOTPROM.FRM;
```

Response if the bootstrap loader and the character generator have been loaded

```
ESC ID

  $MOD$ yymmdd rrvv BOOTPROM.FRM:
  $MOD$ yymmdd rrvv CP15_437.FNT;
```

Response if all data have been loaded

<pre>ESC ID \$MOD\$ yymmdd rrvv BOOTPROM.FRM: \$MOD\$ yymmdd rrvv CP15_437.FNT: \$MOD\$ yymmdd rrvv 5023_STD.MOD;</pre>	<pre>Boot PROM Font PC table 437 Firmware standard</pre>
---	--

Special feature “Electronic journal function“

<pre>ESC ID \$MOD\$ yymmdd rrvv BOOTPROM.FRM: \$MOD\$ yymmdd rrvv CP15_437.FNT: \$MOD\$ yymmdd rrvv 5023_STD.MOD; \$MOD\$ ELJ</pre>	<pre>Boot PROM Font PC table 437 Firmware standard Electronic jour- nal function enabled</pre>
--	---

With the journal function enabled, the recorded data is deleted from the journal memory if the 'secondary character generator location' is selected when loading.

Loading character generators

Indicate "Ready to load character generator"

ESC	F	N	T	(n1)	(n2)	(n3)	(d)	ASCII chars
27	70	78	84	n1	n2	n3	(00/01)	Decimal
1B	46	4E	54	n1	n2	n3	(00/01)	Hexadecimal

Function:

Description:

This command is used to inform the printer that a new character generator should be loaded. All activities in the printer will be stopped, and all data will be deleted. Then the host is informed that the printer is ready to load. The number of bytes to be loaded is also indicated. The following formula is used to calculate the number of bytes to be loaded:

$$\text{Number} = n1 + 256 * n2 + 65536 * n3.$$

Parameter 'd' target

The passbook and document printer with the model variants 'Medium' or 'Comfort' accommodate additional character generators in the extension memory. Thus it is possible to load a second PC table or fonts for the Asian regions up to a maximum size of 2 MB.

d = 00 Primary character generator location (256 KB max.)

d = 01 Secondary (optional) character generator location (2 or 4 MB max.)

'Ready to load' is indicated by sending the sequence **ESC F N T** to the host.

Loading the Character Generator

\$	M	O	D	\$	ASCII chars
36	77	79	68	36	Decimal
24	4D	4F	44	24	Hexadecimal

Function:

\$MOD\$ is a part of the file and may not be transferred again before the data. Data is transferred after the character sequence **\$MOD\$**. It is not allowed to load other data than data with the file extension .FNT. A checksum is placed at the end of the file. After the load process this checksum can be used to verify that the load process was successful.

If the data was transferred without errors, the relevant data ID is provided in the **ESC I D** acknowledgment.

Loading the Firmware

Indicate 'Ready to load'

ESC	M	O	D	(n1)	(n2)	(n3)	ASCII chars
27	77	79	68	n1	n2	n3	Decimal
1B	4D	4F	44	n1	n2	n3	Hexadecimal

Function:

This command is used to inform the bootstrap loader that a new firmware should be loaded. All activities in the printer will be stopped, and old data will be deleted. Then the printer's readiness to load is indicated to the host. The number of bytes to be loaded is also transferred. The following formula is used to calculate the number of bytes to be transferred:

$$\text{Number} = n1 + 256 * n2 + 65536 * n3.$$

'Ready to load' is indicated by sending the sequence **ESC M O D** to the host.

Loading the Firmware

\$	M	O	D	\$	ASCII chars
36	77	79	68	36	Decimal
24	4D	4F	44	24	Hexadecimal

Function:

\$MOD\$ is a part of the file and may not be transferred again before the data. Data is transferred after the character sequence **\$MOD\$**. It is not allowed to load other data than data with the file extension *.MOD. A checksum is placed at the end of the file. After the load process this checksum can be used to verify that the load process was successful.

If the data was transferred without errors, the relevant data ID is provided in the **ESC I D** acknowledgment.

Length of the Transfer

Because the bootstrap loader receives binary data, an end character cannot be used to inform it when the transfer process is ended. For this reason, the length of the transferred is included in the call of the bootstrap loader. The length specification is used to determine how much memory must be deleted from the FLASH EPROM.

The length of the data to be transferred is stored in the file after the file header.

A 48-byte header is stored at the beginning of the file. This ID record has the following structure:

Offset	Length	Contents	Meaning
0	5	\$MOD\$	Identifier
5	1	blank	Separator
6	6	yymmdd	Release date with the format YYMMDD (941101 for 1.11.94)
12	1	blank	Separator
13	4	rrvv	Release and release version (1005 for V01.05)
17	1	blank	Separator
18	8	a..a	Module name (e.g. "5023_STD", "CP15_437")
26	1	.	Separator (point)
27	3	a.a	Extension (MOD, FRM, FNT, PAR)
30	1	00	String terminator
31	1	n1	Length byte 1
32	1	n2	Length byte 2
33	1	n3	Length byte 3 length= n1 + (256*n2) + (65536*n3)
34	14	00..00	reserved
48			END

The header can be used to determine the overall number of bytes to be loaded, including the header itself.

The file header and the checksum can be used to determine that a file is valid:

Check sum calculation:

Sum of all 16-bit words = 0

Acknowledgment of a successful load process:

If the load process was completed successfully, the data ID is returned after 60s max. (typically after 15s):

```
ESC ID
$MOD$ yymdd rrvv BOOTPROM.FRM:
$MOD$ yymdd rrvv CP15__437.FNT:
$MOD$ yymdd rrvv 5023_STD.PAR;
```

The passbook and document printer will be booted again after this acknowledgment if the firmware is available. During the reboot phase the interface cannot be addressed for 10s max.

Problems during the load process:

If the loaded data is determined as not valid, the appropriate file header is missing in the acknowledgment.

If the data transfer is interrupted for 60 seconds min. during the load process, the file header is returned. The bootstrap loader resets to the home position. Any data transferred is invalid, and the load process must be re-started.

Before any load command can be transferred, the system must switch the Centronics interface card to the ECP mode (bi-directional). No data will be processed in the compatible mode

Reading E-Journal Data

ESC	E	L	J	ASCII chars
27	69	77	75	Decimal
1B	45	4C	4A	Hexadecimal

Function:

This command is used to inform the bootstrap loader that the data of the electronic journal function should be copied from the memory module to the electronics. This function is reserved for service calls when it is no longer possible to print data.

The response has the following structure:

Offset	Length	Contents	Meaning
0	3	E L J	Identifier
4	max. 128 KB	ASCII	Journal contents, code range 20..FE + CR, LF 0 ... 128 KB
END	1	EOF	EOF (1A hex)

Control of Asian Character Sets

For passbook and document printers, the Asian character set is loaded via the system interface. This function is available only in device variants with a memory extension.

In addition, the optional memory extension should be selected in the Service menu on the printer's operating panel. The Asian character sets will not be available if these requirements are not fulfilled.

Settings on the printer operating panel

Memory extension		
Memory extension off		Specification of the memory extension
Memory extension E.Journal		
Memory extension 2.CG		
Memory extension GB2312		Asian encoding
Memory extension GB5007		
Memory extension GB5199		
Memory extension BIG5		

The control of the Asian characters is based on the number of characters using the 2-byte encoding.

The following intending formats are currently implemented:

GB 2312-80	VR China	For character assignment see Appendix, section „Chinese Characters in the Pass-book / Document Printer“.
GB 5007	VR China	For character assignment see Appendix, section „Chinese Characters in the Pass-book / Document Printer“.
GB 5199	VR China	For character assignment see Appendix, section „Chinese Characters in the Pass-book / Document Printer“.
BIG5	Traditional Chinese (Hongkong and Taiwan)	For character assignment see Appendix, section „Chinese Characters in the Pass-book / Document Printer“.

When a 2-byte character generator is available, this character generator is automatically enabled after power-on.

After a default font number has been specified, the relevant character is set.

If a default font number is not specified in the character generator, the character set selected from the operating panel menu will be set.

Control sequences under 20h and/or ESC sequences will be executed where possible.

When character codes from the 1-byte range of characters are transferred, the LQ font currently set and the corresponding character set will be printed.

Example:

Switch-over from 1-byte characters to 2-byte characters and vice versa:

ESC [1\$q Switch to 2-byte mode, character set GB2312-80

/h B1 A2	31 32 33	B1 B2	B2 31	0D
Character 1	1-byte character from the EPSON character set	Character 2	Because the character B2/31 does not exist in GB2312, the character B2 is ignored. The character 31 is recognized as a character from the EPSON character set.	Initialize printout

Attributes

The attributes 'bold', 'elongated print', 'condensed print' and 'underscore' can be applied to the Chinese characters. The subscript and superscript attributes are not possible and produce undefined print results.

The text layout functions 'block print', 'centering' and 'right-justified' cannot be used in conjunction with 2-byte characters.

Character pitch (HMI)

Epson ANSI emulation

The character pitch currently set (10, 12 or 15 CPI) will be used when character codes are transferred from the 1-byte character range. The character pitch will be doubled accordingly for Chinese characters (6, 6 or 7.5 CPI). When the attributes 'elongated print' or 'condensed print' are used, the character pitch is multiplied with the factor of 0.5 or 2.

The character set enabled by the operating panel selection will be active after power-on. This presetting can be superseded by the control command shown in the following table.

Pre-setting of the Character Set ESC [n \$ q

CSI		n	\$	q	Name
ESC	[	n	\$	q	ASCII chars
27	91	n	36	113	Decimal
1B	5B	n	24	71	Hexadecimal

Parameter n:

Value	Font	Encoding
n = 0	Epson fonts	1-byte mode EPSON ESC P
n = 1	GB 2312-80	2-byte mode GB2312
n = 2	GB 5007	2-byte mode GB5007
n = 3	GB 5199	2-byte mode GB5199
n = 4 .. 9	GB xxxx	2-byte mode GB (reserved for additional font tables)
n = 10	FANG SONG GB2312-80, GB5007, GB5199 and GB xxxx	2-byte mode simplified Chinese
n = 11 .. 100	Fonts GB.....	2-byte mode simplified Chinese (reserved for additional font tables)
n = 101	BIG 5	2-byte mode BIG5
n = 102 .. 200	BIG 5	2-byte mode BIG5 font (currently reserved for additional font tables)

Specific Operating System Dependencies

Windows NT Drivers

The document printer is delivered with drivers for the operating systems Windows 95/98/NT/2000/XP.

If the document printer is to be connected to a computer with the operating system Windows NT/2000/XP using a serial interface, the following special feature must be observed:



If one of these printer drivers has been installed, other applications can no longer directly address the serial interface assigned.

In this case the Windows print spooler blocks the interface.

Appendix

Command table

Command table for Epson ANSI emulation

Command	ASCII hex	Function
* BEL	07	Signal tone
BS	08	Backspace of one character
HT	09	Horizontal tabulation
LF	0A	Line feed
VT	0B	Vertical tabulation
FF	0C	Sheet ejection
CR	0D	Carriage return
SO	0E	Switching on elongated print for one line
SI	0F	Switching on condensed print
DC 1	11	Printer online
DC 2	12	Switching off condensed print
DC 3	13	Printer offline
DC 4	14	Switching off elongated print
CAN	18	Deleting a character
DEL	7F	Deleting a line
ESC SO	1B 0E	Switching on elongated print for one line
ESC SI	1B 0F	Switching on condensed print
ESC EM (n)	1B 19 n	Paper control
ESC SP (n)	1B 20 n	Determining the character spacing
ESC ! (n)	1B 21 n	Selection of combined print mode
ESC #	1B 23	Deleting the MSB specification
ESC \$ (n) (m)	1B 24 n m	Horizontal positioning (absolute)

Command	ASCII hex	Function
ESC % (n)	1B 25 n	Switching on/ off the character set defined by the user
ESC & (s) (n) (m)	1B 26 s n m	Transferring the character definitions
ESC * (s) (n) (m)	1B 2A s n m	Selecting graphics mode
ESC + (n)	1B 2B n	Selecting n/360 inch line spacing
ESC - (n)	1B 2D n	Switching underlining on/ off
ESC / (c)	1B 2F c	Selecting a vertical tab channel
ESC 0	1B 30	Selecting 1/8 inch line spacing
ESC 2	1B 32	Selecting 1/6 inch line spacing
ESC 3 (n)	1B 33 n	Selecting 1/180 inch line spacing
ESC 4	1B 34	Switching on italic print
ESC 5	1B 35	Switching off italic print
ESC 6	1B 36	Switching on the character set extension
ESC 7	1B 37	Switching off the character set extension
ESC : NUL (n) NUL	1B 3A 00 n 00	Copying the character set into the RAM
ESC <	1B 3C	Selecting unidirectional printing for one line
ESC =	1B 3D	Setting the MSB to 0
ESC >	1B 3E	Setting the MSB to 1
ESC ? (m) (s)	1B 3F m s	Reassigning graphics commands
ESC @	1B 40	Initializing the printer
ESC A (n)	1B 41 n	Selecting n/60 inch line spacing
ESC B ... NUL	1B 42 ... 00	Determining/deleting vertical tabs (channel 0)
ESC C (n)	1B 43 n	Determining the document length at n lines
ESC C NUL (n)	1B 43 00 n	Determining the document length at n inches
ESC D ... NUL	1B 44 ...00	Determining/ deleting horizontal tabs

Command	ASCII hex	Function
ESC E	1B 45	Switching on bold print
ESC F	1B 46	Switching off bold print
ESC G	1B 47	Switching on double impact print
ESC H	1B 48	Switching off double impact print
ESC J (n)	1B 4A n	Carrying out an n/180 inch line feed
ESC K (n) (m)	1B 4B n m	Switching on the graphics mode 'single density'
ESC L (n) (m)	1B 4C n m	Switching on the graphics mode 'double density'
ESC M	1B 4D	Selecting the character size 12 cpi (Elite)
ESC N (n)	1B 4E n	Setting the bottom margin
ESC O	1B 4F	Deleting the bottom margin
ESC P	1B 50	Selecting the character size 10 cpi (Pica)
ESC Q (n)	1B 51 n	Determining the right margin
ESC R (n)	1B 52 n	Selecting a national character set
ESC S (n)	1B 53 n	Switching on superscript/subscript
ESC T	1B 54	Switching off superscript/subscript
ESC U (n)	1B 55 n	Unidirectional print mode on/off
ESC W (n)	1B 57 n	Switching elongated print on/off
ESC Y (n) (m)	1B 59 n m	Switching on the graphics mode 'double density and double rate'
ESC Z (n) (m)	1B 5A n m	Switching on the graphics mode 'quadruple density'
ESC [n ! p	1B 5B n 21 70	Absolute vertical positioning (from the top)
ESC [n ! q	1B 5B n 21 71	Change between document and journal printing
ESC [n # p	1B 5B n 23 70	Relative vertical positioning backwards
ESC [n " p	1B 5B n 22 70	Absolute vertical positioning (from the bottom)

Command	ASCII hex	Function
ESC [n # q	1B 5B n 23 71	Selection of type fonts/ character sets
ESC [n \$ p	1B 5B n 24 70	Paper feed of the document
ESC [n1 .. n5 ! r	1B 5B n1 .. n5 21 72	Parameter block MSR
ESC [" r	1B 5B 22 72	Reading a MSR track
ESC [# r STX .. ETX	1B 5B 23 72 02 ...03	Writing a MSR track
ESC [% r	1B 5B 25 72	Deleting a MSR track
ESC [n ! t	1B 5B n 21 74	Setting control points/initializing the control cycle
ESC [" t	1B 5B 22 74	Requesting the document width
ESC [# t	1B 5B 23 74	Document edge detection
ESC [n \$ t	1B 5B n 24 74	Activating passbook processing
ESC [n % t	1B 5B n 25 74	Specification of the horizontal leading edge
ESC [n (t	1B 5B n 28 74	Mode switch-over for handling end of paper
ESC [n) t	1B 5B n 29 74	Setting control point II
ESC [n * t	1B 5B n 2A 74	Dual station control
ESC [n , t	1B 5B n 2C 74	Increasing the copying power
ESC [n ! z	1B 5B n 21 7A	Global printer status
ESC [" z	1B 5B 22 7A	Requesting special printer messages
ESC [n ; m " z	1B 5B n m 22 7A	Special printer messages
ESC [n # z	1B 5B n 23 7A	Requesting printing unit parameters
ESC [n1 ; ... ; n8 # z	1B 5B n1 .. n8 23 7A	Printing unit parameters
ESC \ (n) (m)	1B 5C n m	Horizontal positioning (relative)
ESC a (n)	1B 61 n	Determining the text adjustment
ESC b (c) .. NUL	1B 62 c .. 00	Setting/deleting vertical tabs for any channel
ESC g	1B 67	Selecting the character size 15 cpi

Command	ASCII hex	Function
ESC k (n)	1B 6B n	Selecting the LQ type font
ESC l (n)	1B 6C n	Determining the left margin
ESC p (n)	1B 70 n	Switching proportional spacing on/off
* ESC r (n)	1B 72 n	Selecting the print colour
* ESC s (n)	1B 73 n	Switching half-rate printing on/off
ESC t (n)	1B 74 n	Selecting the character set
ESC x (n)	1B 78 n	Switching over the print quality (Draft/LQ)

* = Non-executable commands

If a command is non-executable (dependent on the configuration), hardware specific commands will be ignored.

Definition of barcode printing for T5023

Escape sequence

The definition for barcode printing is:

```
ESC [ m ; h ; z ; n * r STX (data) ETX
1B 5B 3X 3B 3X 3X 3B 3X 3X 3B 3X 2A 72 02 (data) 03
```

Prints barcode according to the characteristics defined by the following parameters. The ';' separates the parameters. The final code ('*' 'r') closes the parameter part. The barcode data is enclosed with STX (start of text) and ETX (end of text).

The values in the parameter part are listed below. **Only the listed values are valid!** The range of every parameter is 1 to 4 digit. For example 5 can be send as 5, 05, 005 or 0005 and has always the same value.

Barcode type

The parameter 'm' defines the following barcode types:

m	Barcode type
5	CODE39 (lower case bar code data 'a'..'z' is automatic set to upper case 'A'..'Z').
7	2/5 INTERLEAVED (a odd number of bar code data is automatic filled with a leading zero).

If one wrong data found in barcode data, nothing will be printed and the printer shows 'wrong order'.

Barcode height

The parameter 'h' defines the barcode height:

h	Barcode height
00	DEFAULT (at least 5 mm or 15 % of Barcode length [**]).
01 - 10	Height as number h of passes [*]

Barcode zoom coefficient

The parameter 'z' expresses the horizontal zoom coefficient in decimals. The following values are allowed:

z	Values
00-09	Ignored values
10-34	Acceptable values (10 = basic width. 15 is 1.5 * basic width, 20 is double width, etc.)

Human readable line

The parameter 'n' comprising one byte, enables or disables plain language printing of the barcode ('Human Readable Line' - H.R.L.) in the lower part:

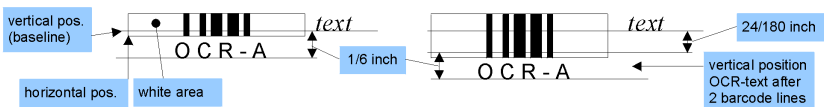
n	Human Readable Line
0	Disabled
1	Enabled

'Human readable' characters are printed with the OCR-A font, where no zoom factor is applied.

Printposition

horizontal: the horizontal position ist the beginning of white area.
This area is at least 10 times of small barcode line [*] and depends of the zoom-factor.

vertical: the vertical position ist the baseline of text (needle 20).



The print position after bar code printing is the left margin of last printed line.

[*] One pass = 8/60" at 24 pin

[**] Specification EN 800 (code 39) / 801 (Interleaved 2 of 5)

Loader commands

Command	ASCII hex	Function
ESC BEL L n	1B 07 4C n	Switching over to load function
ESC BEL E	1B 07 45	Leaving the load function
ESC I D	1B 49 44	Requesting data characteristic
ESC F N T (n1) (n2) (n3) (d)	1B 46 4E 54 n1 n2 n3 d	Ready to load character generator
\$ M O D \$ (Daten)	24 4D 4F 44 24	Character generator/firmware data transmitted
ESC M O D (n1) (n2) (n3)	1B 4D 4F 44 n1 n2 n3	Ready to load firmware

E-Journal commands

Command	ASCII hex	Function
ESC E L J	1B 45 4C 4A	Reading E. Journal data

Character Sets

Font	Code Table	Font Type	Font Sizes	National Variants
CP15_437.FNT	Code Page 437	DQ, LQ Roman, LQ Sans Serif	10, 12, 15 CPI proportional	X
	Includes additional fonts ISO 8859 - 2/-5/-7/-8/-9 (compatible with HPR4905)	DQ, LQ Roman, LQ Sans Serif	10, 12, 15 CPI	
	Eurobanking (limited)	OCR-A / -B	10 CPI	
CP15C437.FNT	Code Page C437	DQ, LQ Roman, LQ Sans Serif	10, 12, 15 CPI proportional	X
	for the Asian market (the dollar character was replaced by the Chinese character of currency)			
	Includes additional fonts ISO 8859 - 2/-5/-7/-8/-9 (compatible with HPR4905)	DQ, LQ Roman, LQ Sans Serif	10, 12, 15 CPI	
	Eurobanking (limited)	OCR-A / -B	10 CPI	
CP15_775.FNT	Code Page 775 Includes PC Code Page 775 with baltic characters	DQ, LQ Roman, LQ Sans Serif	10, 12, 15 cpi	----
	Eurobanking (limited)	OCR-A / -B	10 cpi	
CP15_850.FNT	Code Page 850 Latin 1 Includes PC Code Page 850 Latin 1 Western/Northern Europe	DQ, LQ Roman, LQ Sans Serif	10, 12, 15 cpi	----
	Eurobanking (limited)	OCR-A / -B	10 cpi	
CP15_852.FNT	Code Page 852 Latin 2 Includes PC Code Page 852 Latin 2 Eastern Europe	DQ, LQ Roman, LQ Sans Serif	10, 12, 15 cpi	----
	Eurobanking (limited)	OCR-A / -B	10 cpi	
CP15_855.FNT	Code Page 855 Includes PC Code Page 855 Macedonia	DQ, LQ Roman, LQ Sans Serif	10, 12, 15 cpi	----
	Eurobanking (limited)	OCR-A / -B	10 cpi	
CP15_857.FNT	Code Page 857 Latin 5 Includes PC Code Page 857 Latin 5 Turkey	DQ, LQ Roman, LQ Sans Serif	10, 12, 15 cpi	----
	Eurobanking (limited)	OCR-A / -B	10 cpi	
CP15_858.FNT	PC Code Page 858 Code Page 858 (CP 850 with Euro characters on D5)	DQ, LQ Roman, LQ Sans Serif	10, 12, 15 cpi	----
	Eurobanking (limited)	OCR-A / -B	10 cpi	
CP15_860.FNT	Code Page 860 Portugal	DQ, LQ Roman, LQ Sans Serif	10, 12, 15 cpi	----
	Eurobanking (limited)	OCR-A / -B	10 cpi	

Font	Code Table	Font Type	Font Sizes	National Variants
CP15_866.FNT	Code Page 866 Latin / Cyrillic	DQ, LQ Roman, LQ Sans Serif	10, 12, 15 cpi	----
	Eurobanking (limited)	OCR-A / -B	10 cpi	
CP15_869.FNT	Code Page 869 Latin / Greek	DQ, LQ Roman, LQ Sans Serif	10, 12, 15 cpi	----
	Eurobanking (limited)	OCR-A / -B	10 cpi	
CP15THAI.FNT	Thailand character set with customer-specific/national assignment	DQ, LQ Roman, LQ Sans Serif, Script	10, 12, 15 cpi	----
	Eurobanking (limited)		10, 12 cpi	
CP151250.FNT	Windows Code Page 1250 Latin 2	DQ, LQ Roman, LQ Sans Serif	10, 12, 15 cpi	----
	Eurobanking (limited)	OCR-A / -B	10 cpi	
CP151251.FNT	Windows Code Page 1251 Cyrillic	DQ, LQ Roman, LQ Sans Serif	10, 12, 15 cpi	----
	Eurobanking (limited)	OCR-A / -B	10 cpi	
CP151252.FNT	Windows Code Page 1252 Latin 1	DQ, LQ Roman, LQ Sans Serif	10, 12, 15 cpi	----
	Eurobanking (limited)	OCR-A / -B	10 cpi	
CP151253.FNT	Windows Code Page 1253 Greek	DQ, LQ Roman, LQ Sans Serif	10, 12, 15 cpi	----
	Eurobanking (limited)	OCR-A / -B	10 cpi	
CP151254.FNT	Windows Code Page 1254 Latin 5	DQ, LQ Roman, LQ Sans Serif	10, 12, 15 cpi	----
	Eurobanking (limited)	OCR-A / -B	10 cpi	
CP151255.FNT	Windows Code Page 1255 Hebrew	DQ, LQ Roman, LQ Sans Serif	10, 12, 15 cpi	----
	Eurobanking (limited)	OCR-A / -B	10 cpi	
CP151256.FNT	Windows Code Page 1256 Arabic	DQ, LQ Roman, LQ Sans Serif	10, 12, 15 cpi	----
	Eurobanking (limited)	OCR-A / -B	10 cpi	
CP151257.FNT	Windows Code Page 1257 Baltic Rim	DQ, LQ Roman, LQ Sans Serif	10, 12, 15 cpi	----
	Eurobanking (limited)	OCR-A / -B	10 cpi	
CP15ISO2.FNT	ISO 8859-2 East Europe	DQ, LQ-Roman, LQ-Sans Serif	10, 12, 15 cpi	----
	Eurobanking (limited)	OCR-A / -B	10 cpi	

Code Page 437

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2	"	2	B	R	b	r	é	Æ	ó	⌘	⌘	⌘	⌘	⌘	⌘	⌘
3	#	3	C	S	c	s	â	ô	ú		†	⌘	⌘	⌘	⌘	⌘
4	\$	4	D	T	d	t	ä	ö	ñ	†	-	⌘	⌘	⌘	⌘	⌘
5	%	5	E	U	e	u	à	ò	ñ	†	†	⌘	⌘	⌘	⌘	⌘
6	&	6	F	V	f	v	ã	û	ä	†	†	⌘	⌘	⌘	⌘	⌘
7	'	7	G	W	g	w	ç	ù	ò	†	†	†	†	⌘	⌘	⌘
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9)	9	I	Y	i	y	ë	Ö	⌘	†	⌘	⌘	⌘	⌘	⌘	⌘
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ISO 8859-2 Latin No. 2

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ISO 8859-5 Cyrillic

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3		#	3	C	S	c	s		Ѓ	Г	У	г	у	ѓ		
4		\$	4	D	T	d	t		Є	Д	Ф	д	ф	є		
5		%	5	E	U	e	u		Є	Х	е	х	є			
6		&	6	F	V	f	v		І	Ж	Ц	ж	ц	і		
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ISO 8859-7 Greek

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2		"	2	B	R	b	r			´	²	B		β	ς	
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ISO 8859-8 Hebrew

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3		#	3	C	S	c	s			£	³				ט	ף
4		\$	4	D	T	d	t			¤	'				ה	פ
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ISO 8859-9 Latin No. 5

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5	%	5	E	U	e	u					¥	μ	Ǻ	Ö	ǻ	ö
6	&	6	F	V	f	v					¦	¶	Æ	Ö	æ	ö
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9)	9	I	Y	i	y					©	¹	É	Û	é	û
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B	+	;	K	[k	{					«	»	Ë	Û	ë	û
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ISO 8859-15

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2		"	2	B	R	b	r			φ	²	Â	Ò	â	ò			
3		#	3	C	S	c	s			£	³	Û	Ó	û	ó			
4		\$	4	D	T	d	t			€	Ž	Ä	Ö	ä	ö			
5		%	5	E	U	e	u			¥	μ	Å	Ö	å	ö			
6		&	6	F	V	f	v			Š	Ŧ	Æ	Ö	æ	ö			
7		'	7	G	W	g	w			§	·	Ç	×	ç	÷			
8		(8	H	X	h	x			š	ž	È	Ø	è	ø			
9)	9	I	Y	i	y			©	'	É	Ù	é	ù			
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OCR-A

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1		!	1	A	Q	?	?	?	?	?	?	?	?	?	?	?
2		"	2	B	R	?	?	?	?	?	?	?	?	?	?	?
3		#	3	C	S	?	?	?	?	?	?	?	?	?	?	?
4		\$	4	D	T	?	?	?	?	?	?	?	?	?	?	?
5		%	5	E	U	?	?	?	?	?	?	?	?	?	?	?
6		&	6	F	V	?	?	?	?	?	?	?	?	?	?	?
7		'	7	G	W	?	?	?	?	?	?	?	?	?	?	?
8		?	8	B	H	X	?	?	?	?	?	?	?	?	?	?
9		?	9	I	Y	?	?	?	?	?	?	?	?	?	?	?
A		*	:	J	Z	?	?	?	?	?	?	?	?	?	?	?
B		+	;	K	?	?	?	?	?	?	?	?	?	?	?	?
C		,	´	L	?	?	?	?	?	?	?	?	?	?	?	?
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F		/	?	0	?	?		?	?	?	?	?	?	?	?	?

OCR-B

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
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1	!	1	A	Q	a	q	ü	æ	í	☐	⊥	⊥	β	±		
2	"	2	B	R	b	r	é	Æ	ó	☐	⊥	⊥	?	≥		
3	#	3	C	S	c	s	â	ô	ú		†	⊥	?	≤		
4	\$	4	D	T	d	t	ä	ö	ñ	†	—	⊥	?	∫		
5	%	5	E	U	e	u	à	ò	ñ	†	†	⊥	?	∫		
6	&	6	F	V	f	v	ä	ú	æ	†	†	⊥	⊥	?	÷	
7	'	7	G	W	g	w	ç	ù	ò	⊥	†	†	?	≈		
8	(8	H	X	h	x	ê	ý	¿	⊥	⊥	†	?	°		
9)	9	I	Y	i	y	ë	ö	⊥	⊥	⊥	†	?	•		
A	*	:	J	Z	j	z	è	Ù	⊥	⊥	⊥	⊥	?	•		
B	+	;	K	[k	{	ï	ç	‡	⊥	⊥	⊥	?	√		
C	,	<	L	\	l		î	£	‡	⊥	⊥	⊥	?	ⁿ		
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Code Page ISO 2

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2		"	2	B	R	b	r			~	.	Â	â	Ã	ã	Ñ
3		#	3	C	S	c	s			Ł	ł	À	á	ă	ó	
4		\$	4	D	T	d	t			¤	´	Ä	ä	Å	å	Ö
5		%	5	E	U	e	u			Č	č	Ľ	ľ	Ó	í	ó
6		&	6	F	V	f	v			Š	š	Ć	ć	Č	č	Ö
7		'	7	G	W	g	w			Š	š	Ç	ç	×	÷	
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9)	9	I	Y	i	y			Š	š	É	é	Ë	ë	Ü
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Code Page 775 Latin / Baltic

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3		#	3	C	S	c	s		ž		ē	Ņ	≡			
4		\$	4	D	T	d	t		ž	Ķ	-	ī	ō	π		
5		%	5	E	U	e	u		ž	Ā	+	š	ō	š		
6		&	6	F	V	f	v		"	č	Ū	Ū	μ	÷		
7		'	7	G	W	g	w		!	Ē	Ū	ū	Ņ	„		
8		(8	H	X	h	x		⊙	É	Ļ	ž	ķ	°		
9)	9	I	Y	i	y		⊙	†	Ŧ	Ķ	•			
A		*	:	J	Z	j	z		-		±	Ŧ	•			
B		+	;	K	[k	{		½	Ŧ	Ŧ	■]	'		
C		,	<	L	\	l	!		¼	Ŧ	Ŧ	■	Ŧ	³		
D		-	=	M]	m	}		I	=		ē	²			
E		.	>	N	^	n	~		»	š	†		Ŧ	■		
F		/	?	O	_	o			«	Ŧ	ž	■	'			

Code Page 850 Latin 1

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0			0	@	P	'	p	ç	é	á	⌘	Ⓕ	ó	-		
1		!	1	A	Q	a	q	ü	æ	í	⌘	±	Ð	β	±	
2		"	2	B	R	b	r	é	Æ	ó	⌘	⌘	ê	ô	=	
3		#	3	C	S	c	s	â	ô	ú	|	†	È	ò	⌘	
4		\$	4	D	T	d	t	ä	ö	ñ	†	-	È	ø	⌘	
5		%	5	E	U	e	u	à	ò	ñ	Á	†	ı	Ö	§	
6		&	6	F	V	f	v	â	û	â	Â	ã	í	μ	÷	
7		'	7	G	W	g	w	ç	ù	ø	À	Å	î	þ	,	
8		(	8	H	X	h	x	ê	ÿ	¿	⌘	⌘	İ	þ	°	
9		)	9	I	Y	i	y	ë	ö	⌘	⌘	⌘	ı	ú	¨	
A		*	:	J	Z	j	z	è	ü	¬	||	⌘	⌘	ı	°	
B		+	;	K	[	k	{	ï	ø	½	⌘	⌘	■	ı	¹	
C		,	<	L	\	l	|	î	£	¼	⌘	⌘	■	ı	³	
D		-	=	M	]	m	}	ï	ø	ı	⌘	=	ı	ı	²	
E		.	>	N	^	n	~	Ä	×	«	¥	⌘	ı	-	■	
F		/	?	O	_	o		A	f	»	⌘	*	■	'		

Code Page 852 Latin 2

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	
0					0	@	P	'	p	Ç	É	á	☼	Ł	đ	Ó	-
1		!	1	A	Q	a	q	ü	í	☼	±	Ð	ß	“			
2		"	2	B	R	b	r	é	í	ó	☼	Ť	Ď	Ů	.		
3		#	3	C	S	c	s	â	ô	ú	|	†	Ě	Ň	˘		
4		\$	4	D	T	d	t	ä	ö	Ā	†	-	ď	ň	˘		
5		%	5	E	U	e	u	Ů	ł	ą	†	Ń	ń	§			
6		&	6	F	V	f	v	ć	ź	Ā	Ā	ı	š	÷			
7		'	7	G	W	g	w	ç	ś	ž	Ě	ă	î	ș	,		
8		(	8	H	X	h	x	ł	ś	Ę	Ş	Ł	ě	Ř	°		
9		)	9	I	Y	i	y	ë	ö	ę	†	Ŧ	†	ú	“		
A		*	:	J	Z	j	z	ő	ü	||	±	Ŧ	Ŧ	ı	ı		
B		+	;	K	[	k	{	ő	ř	ż	†	†	■	Ů	Ů		
C		,	<	L	\	l	!	ı	č	č	±	†	■	ý	ř		
D		-	=	M	]	m	}	ż	ł	ş	ż	=	†	ý	ř		
E		.	>	N	^	n	~	Ā	×	«	ż	†	Ů	†	■		
F		/	?	O	_	o		ć	č	»	†	ı	■	'			

Code Page 855

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0				0	@	P	`	p				°	À		à	
1			!	1	A	Q	a	q		´	ı	±	Á	Ñ	á	ñ
2			„	2	B	R	b	r	,	´	¢		Â	Ò	â	ò
3			#	3	C	S	c	s	f	“	£		Ã	Ó	ã	ó
4			\$	4	D	T	d	t	„	”	¤	´	Ä	Ô	ä	ô
5			%	5	E	U	e	u	...	•	¥	µ	Å	Õ	å	õ
6			&	6	F	V	f	v	†	-		¶	Æ	Ö	æ	ö
7			´	7	G	W	g	w	‡	-	§	·	Ç		ç	÷
8			(	8	H	X	h	x			¨	,	È	Ø	è	ø
9			)	9	I	Y	i	y	%	™	©		É	Ù	é	ù
A			*	:	J	Z	j	z			ª	º	Ê	Ú	ê	ú
B			+	;	K	[	k	{	<	>	«	»	Ë	Û	ë	û
C			,	<	L	\	l	|	œ	œ	¬		Ï	Ü	ï	ü
D			-	=	M	]	m	}					Í	Ý	í	
E			.	>	N	^	n	~			®		Î		î	
F			/	?	O	_	o			ÿ		ı	Ï	ß	ï	

Code Page 857 Latin 5

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0					0	@	P	'	p	Ç	É	á	⌘	Ł	ó	-
1		!	1	A	Q	a	q	ü	æ	í	±	±	±	±	±	±
2		"	2	B	R	b	r	é	Æ	ó	⌘	⌘	⌘	⌘	⌘	⌘
3		#	3	C	S	c	s	â	ô	ú	|	|	|	|	|	⌘
4		\$	4	D	T	d	t	ä	ö	ñ	|	-	È	Ö	⌘	⌘
5		%	5	E	U	e	u	à	ò	Ñ	Á	†	Ö	§	§	§
6		&	6	F	V	f	v	ã	û	ğ	Â	ã	İ	μ	÷	÷
7		'	7	G	W	g	w	ç	ù	ğ	À	Ã	İ	,	,	,
8		(	8	H	X	h	x	ê	ı	ı	ı	ı	ı	ı	ı	ı
9		)	9	I	Y	i	y	ë	ö	⌘	⌘	⌘	⌘	⌘	⌘	⌘
A		*	:	J	Z	j	z	è	ü	ı	ı	ı	ı	ı	ı	ı
B		+	;	K	[	k	{	ı	ø	½	⌘	⌘	⌘	⌘	⌘	⌘
C		,	<	L	\	l	!	ı	£	¼	⌘	⌘	⌘	⌘	⌘	⌘
D		-	=	M	]	m	}	ı	ø	ı	ı	ı	ı	ı	ı	ı
E		.	>	N	^	n	~	Ä	Ş	«	¥	†	İ	-	■	■
F		/	?	O	_	o		Å	Ş	»	ı	ı	ı	ı	ı	ı

PC Code Page 858

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0				0	@	P	'	p	ç	É	á	•	ˆ	ø	ó	-
1	!	1	A	Q	a	q	Ü	æ	ı	ı	ı	ı	ı	ı	ı	ı
2	"	2	B	R	b	r	é	Æ	ó	•	ı	ı	ı	ı	ı	=
3	#	3	C	S	c	s	â	ô	ú	|	|	ı	ı	ı	ı	ı
4	\$	4	D	T	d	t	ä	ö	ñ	|	-	ı	ı	ı	ı	ı
5	%	5	E	U	e	u	à	ò	ñ	Á	†	ı	ı	ı	ı	ı
6	&	6	F	V	f	v	â	û	â	Ä	ä	ı	ı	ı	ı	ı
7	'	7	G	W	g	w	ç	ù	ö	Ä	Ä	ı	ı	ı	ı	ı
8	(	8	H	X	h	x	ê	ÿ	ı	ı	ı	ı	ı	ı	ı	ı
9	)	9	I	Y	i	y	ë	ö	ı	ı	ı	ı	ı	ı	ı	ı
A	*	:	J	Z	j	z	è	ü	-	|	ı	ı	ı	ı	ı	ı
B	+	;	K	[	k	{	ı	ı	ı	ı	ı	ı	ı	ı	ı	ı
C	,	<	L	\	ı	ı	ı	ı	ı	ı	ı	ı	ı	ı	ı	ı
D	-	=	M	]	m	}	ı	ı	ı	ı	ı	ı	ı	ı	ı	ı
E	.	>	N	^	n	~	Ä	x	«	ı	ı	ı	ı	ı	ı	ı
F	/	?	O	_	o		Ä	f	»	ı	ı	ı	ı	ı	ı	ı

Code Page 860 (Portugal)

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	
0					0	@	P	'	p	Ç	É	á	⋯	⊥	⊥	α	≡
1		!	1	A	Q	a	q	ü	À	í	⋯	⊥	⊥	β	±		
2		"	2	B	R	b	r	é	È	ó	⋯	⊥	⊥	Γ	≥		
3		#	3	C	S	c	s	â	ô	ú	|	⊥	⊥	π	≤		
4		\$	4	D	T	d	t	ã	õ	ñ	|	-	⊥	Σ	∫		
5		%	5	E	U	e	u	à	ò	ñ	≠	⊥	⊥	σ	∫		
6		&	6	F	V	f	v	Á	Ú	ã	⊥	⊥	⊥	μ	÷		
7		'	7	G	W	g	w	ç	ù	õ	⊥	⊥	⊥	τ	≈		
8		(	8	H	X	h	x	ê	ì	ç	⊥	⊥	⊥	φ	°	
9		)	9	I	Y	i	y	ê	õ	ò	⊥	⊥	⊥	θ	.	
A		*	:	J	Z	j	z	è	ü	ç	⊥	⊥	⊥	Ω	.		
B		+	;	K	[	k	{	í	ç	½	⊥	⊥	⊥	δ	√	
C		,	<	L	\	l	!	ó	£	‡	⊥	⊥	⊥	∞	ⁿ		
D		-	=	M	]	m	}	ì	ù	ç	⊥	⊥	⊥	∅	²	
E		.	>	N	^	n	~	ã	ç	«	⊥	⊥	⊥	ε	■		
F		/	?	O	_	o		À	Ó	»	⊥	⊥	⊥	∅	∅		

For addresses 00_h to 7F_h, see Code Page 437.

Code Page 866 Latin/Cyrillic

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F			
0						0	@	P	'	p	A	P	a	␣	L	␣	p	Ё	
1						!	1	A	Q	a	q	Б	С	б	␣	␣	с	ё	
2						"	2	B	R	b	r	В	Т	в	␣	␣	т	е	
3						#	3	С	С	с	с	Г	У	г	|	␣	␣	у	е
4						\$	4	D	T	d	t	Д	Ф	д	|	-	␣	ф	ї
5						%	5	E	U	e	u	E	X	e	␣	␣	␣	␣	ı
6						&	6	F	V	f	v	Ж	Ц	ж	␣	␣	␣	␣	ў
7						'	7	G	W	g	w	З	Ч	з	␣	␣	␣	␣	ў
8						(	8	H	X	h	x	И	Ш	и	␣	␣	␣	␣	°
9						)	9	I	Y	i	y	Й	Щ	й	␣	␣	␣	␣	•
A						*	:	J	Z	j	z	К	Ь	к	␣	␣	␣	␣	·
B						+	;	K	[	k	{	Л	Ы	л	␣	␣	␣	␣	√
C						,	<	L	\	l	!	М	Ь	м	␣	␣	␣	␣	№
D						-	=	M	]	m	}	Н	Э	н	␣	␣	␣	␣	α
E						.	>	N	^	n	~	О	Ю	о	␣	␣	␣	␣	■
F						/	?	О	_	o		П	Я	п	␣	␣	␣	␣	я

Code Page 869 Latin/Greek

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	
0					0	@	P	'	p		I	İ	☐	L	T	Ç	-
1		!	1	A	Q	a	q		İ	ı	☐	±	Y	η	±		
2		"	2	B	R	b	r		Ó	ó	☐	τ	Φ	θ	υ		
3		#	3	C	S	c	s		Ú	ú	|	†	X	ι	φ		
4		\$	4	D	T	d	t		A	ı	-	ψ	κ	χ			
5		%	5	E	U	e	u		Y	B	K	†	Ω	λ	§		
6		&	6	F	V	f	v		À	ÿ	Γ	Λ	Π	α	μ	ψ	
7		'	7	G	W	g	w		⊙	Δ	M	P	β	v	^		
8		(	8	H	X	h	x		ˆ	Ω	E	N	Ⓛ	γ	ξ	°
9		)	9	I	Y	i	y		ˆ	²	Z	☐	☐	☐	☐	☐
A		*	:	J	Z	j	z		³	H	||	Ⓛ	☐	☐	☐	☐	
B		+	;	K	[	k	{		`	á	½	☐	☐	☐	☐	☐
C		,	<	L	\	l	|		'	ε	θ	☐	☐	☐	☐	☐	
D		-	=	M	]	m	}		E	é	I	Ξ	=	δ	ς	ώ
E		.	>	N	^	n	~		-	ñ	«	☐	☐	☐	☐	☐	
F		/	?	O	_	o	☐		H	ı	»	☐	☐	☐	☐	☐	

Thailand Character Set (customer specific)

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0						0	@	P	'	p	+	๒	๓	๔	๕	๖
1		!	1	A	Q	a	q	+	๕	๖	๗	๘	๙	๐	๑	๒
2		"	2	B	R	b	r	+	๓	๔	๕	๖	๗	๘	๙	๐
3		#	3	C	S	c	s	+	๓	๔	๕	๖	๗	๘	๙	๐
4		\$	4	D	T	d	t	+	๓	๔	๕	๖	๗	๘	๙	๐
5		%	5	E	U	e	u	-	๓	๔	๕	๖	๗	๘	๙	๐
6		&	6	F	V	f	v	|	๓	๔	๕	๖	๗	๘	๙	๐
7		'	7	G	W	g	w	+	๓	๔	๕	๖	๗	๘	๙	๐
8		(	8	H	X	h	x	+	๓	๔	๕	๖	๗	๘	๙	๐
9		)	9	I	Y	i	y	+	๓	๔	๕	๖	๗	๘	๙	๐
A		*	:	J	Z	j	z	+	๓	๔	๕	๖	๗	๘	๙	๐
B		+	;	K	[	k	{	+	๓	๔	๕	๖	๗	๘	๙	๐
C		,	<	L	\	l	|	+	๓	๔	๕	๖	๗	๘	๙	๐
D		-	=	M	]	m	}	+	๓	๔	๕	๖	๗	๘	๙	๐
E		.	>	N	^	n	~	+	๓	๔	๕	๖	๗	๘	๙	๐
F		/	?	O	_	o		+	๓	๔	๕	๖	๗	๘	๙	๐

- # 550 ThaiRoman
- # 553 ThaiDQ
- # 560 ThaiScript

The customer specific character set can **only** be controlled with the font number and the respective ESC sequence (see the section "Selection of type fonts/ character sets" in the chapter "Additional commands").

1250 Windows Latin 2

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0				0	@	P	`	p	€		°	Ř	Đ	ř	đ	
1	!	1	A	Q	a	q	´	˘	±	Á	Ñ	á	ñ			
2	"	2	B	R	b	r	,	’	˘	,	Á	Ñ	á	ñ		
3	#	3	C	S	c	s	“	”	Ł	ł	Å	å	Ó	ó		
4	\$	4	D	T	d	t	„	”	¤	’	Ä	ä	Ö	ö		
5	%	5	E	U	e	u	…	·	À	µ	Ł	ó	í	ó		
6	&	6	F	V	f	v	†	-	‡	Ó	Ö	ó	ö			
7	’	7	G	W	g	w	‡	-	§	·	Ç	ç	×	÷		
8	(	8	H	X	h	x			ˆ	·	Č	Ř	č	ř		
9	)	9	I	Y	i	y	‰	™	©	·	ą	É	Ů	é	ů	
A	*	:	J	Z	j	z	Š	š	Š	š	Ę	Ú	ę	ú		
B	+	;	K	[	k	{	<	>	«	»	Ě	Ů	ě	ů		
C	,	<	L	\	l	|	š	ś	→	Ł	Ě	Ů	ě	ů		
D	-	=	M	]	m	}	ř	ř	“	”	ı	Ÿ	ı	Ÿ		
E	.	>	N	^	n	~	ž	ž	⊕	’	ı	ı	ı	ı		
F	/	?	O	_	o		ž	ž	ž	ž	Đ	B	đ	B	đ	

1251 Windows Cyrillic

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0					0	@	P	`	р	Ъ	ђ	°	А	Р	а	р
1		!	1	А	Q	а	q	ѓ	'	Ў	±	Б	С	б	с	
2		"	2	В	R	в	г	,	'	Ў	І	В	Т	в	т	
3		#	3	С	S	с	ѕ	“	”	Ј	і	Г	У	г	у	
4		\$	4	Д	T	д	т	„	”	Ѡ	Г	Д	Ф	д	ф	
5	я	%	5	Е	U	е	u	…	·	Г	μ	Е	Х	е	х	
6		&	6	F	V	f	v	†	-	‡	Ж	Ц	ж	ц		
7		'	7	G	W	g	w	‡	-	§	·	З	Ч	з	ч	
8		(	8	Н	X	н	х	€		Ё	ё	И	Ш	и	ш	
9		)	9	I	Y	i	y	‰	™	Ѡ	Њ	Щ	й	щ		
A		*	:	J	Z	j	z	Љ	љ	Є	є	К	Ъ	к	ъ	
B		+	;	K	[	k	{	<	>	«	»	Л	Ы	л	ы	
C		,	<	L	\	l	|	Њ	њ	ˆ	ј	М	Ь	м	ь	
D		-	=	M	]	m	}	К	ќ	Š	Н	З	Н	э		
E		.	>	N	^	n	~	Ђ	ђ	⊕	ѕ	О	Ю	о	ю	
F		/	?	О	_	о		Ц	ц	Ї	ї	П	Я	п		

1252 Windows Latin 1

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0				0	@	P	`	p	€		°	À	Ð	à	ø	
1		!	1	A	Q	a	q	'	;	±	Á	Ñ	á	ñ		
2		"	2	B	R	b	r	,	'	¢	²	Â	Ô	â	ò	
3		#	3	C	S	c	s	f	"	£	³	Ã	Ó	ã	ó	
4		\$	4	D	T	d	t	„	”	¤	´	Ä	Ö	ä	ö	
5	ÿ		5	E	U	e	u	...	·	¥	µ	Å	Ö	å	ö	
6		&	6	F	V	f	v	†	-	‡	¶	Æ	Ö	æ	ö	
7		'	7	G	W	g	w	‡	-	§	·	Ç	×	ç	÷	
8		(	8	H	X	h	x	^	~	¨	·	È	Ø	è	ø	
9		)	9	I	Y	i	y		™	©	¹	É	Ù	é	ù	
A		*	:	J	Z	j	z	š	š	à	ò	Ê	Ú	ê	ú	
B		+	;	K	[	k	{	<	>	«	»	Ë	Û	ë	û	
C		,	<	L	\	l	|	Œ	œ	¬	¼	Ì	Ü	ì	ü	
D		-	=	M	]	m	}				½	Í	Ý	í	ý	
E		.	>	N	^	n	~			®	¾	Î	Þ	î	þ	
F		/	?	O	_	o				ÿ	¯	Ï	ß	ï	ÿ	

1253 Windows Greek

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0				0	@	P	`	p	€		°	ı	Π	Ù	π	
1		!	1	A	Q	a	q	'	ˆ	±	A	P	α	ρ		
2		"	2	B	R	b	r	,	'	²	B		β	ç		
3		#	3	C	S	c	s	f	"	£	³	Γ	Σ	Υ	σ	
4		\$	4	D	T	d	t	„	”	α	'	Δ	Τ	δ	τ	
5		%	5	E	U	e	u	...	·	¥	μ	E	Υ	ε	υ	
6		&	6	F	V	f	v	†	-	‡	¶	Z	Φ	Ç	ø	
7		'	7	G	W	g	w	‡	-	§	·	H	X	η	χ	
8		(	8	H	X	h	x					Ε	Θ	Ψ	θ	ψ
9		)	9	I	Y	i	y	‰	™	©	Η	Ι	Ω	ι	ω	
A		*	:	J	Z	j	z			®	Ι	Κ	Ī	κ	ī	
B		+	;	K	[	k	{	<	>	«	»	Λ	ÿ	λ	ÿ	
C		,	<	L	\	l	|			¬	Ό	Μ	ά	μ	ό	
D		-	=	M	]	m	}				½	N	é	v	ú	
E		.	>	N	^	n	~			®	Υ	Ξ	ή	ξ	ώ	
F		/	?	O	_	o				-	Ω	O	ı	o		

1254 Windows Latin 5

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0				0	@	P	`	p	€		°	À	Ǻ	à	ǻ	
1		!	1	A	Q	a	q	'	i	±	Á	Ñ	á	ñ		
2		"	2	B	R	b	r	,	'	¢	²	Â	Ò	â	ò	
3		#	3	C	S	c	s	f	"	£	³	Ã	Ó	ã	ó	
4		\$	4	D	T	d	t	„	”	¤	´	Ä	Ô	ä	ô	
5	ÿ	%	5	E	U	e	u	...	·	¥	µ	Å	Ö	å	ö	
6		&	6	F	V	f	v	†	-	‡	¶	Æ	Ö	æ	ö	
7		'	7	G	W	g	w	‡	-	§	·	Ç	×	ç	÷	
8		(	8	H	X	h	x	^	~	¨	·	È	Ø	è	ø	
9		)	9	I	Y	i	y	%	™	©	¹	É	Ù	é	ù	
A		*	:	J	Z	j	z	Š	š	Ž	ž	Ê	Ú	ê	ú	
B		+	;	K	[	k	{	<	>	«	»	Ë	Û	ë	û	
C		,	<	L	\	l	|	Œ	œ	¬	¼	Ï	Ü	ï	ü	
D		-	=	M	]	m	}					½	Í	í	ï	
E		.	>	N	^	n	~			®	¾	İ	Ş	ı	ş	
F		/	?	O	_	o				ÿ	˘	İ	ß	ı		

1255 Windows Hebrew

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0			0	@	P	`	p	€		°	,	ı	ı	ı	ı	ı
1		!	1	A	Q	a	q		'	±	..			ı	ı	ı
2		"	2	B	R	b	r	,	'	¢	²	ı		ı	ı	ı
3		#	3	C	S	c	s	f	"	£	³	ı		ı	ı	ı
4		\$	4	D	T	d	t	„	"	€	´	ı	ı	ı	ı	ı
5		%	5	E	U	e	u	...	·	¥	µ	ı	ı	ı	ı	ı
6		&	6	F	V	f	v	†	-	!	¶	ı	ı	ı	ı	ı
7		'	7	G	W	g	w	‡	-	§	ı	ı	ı	ı	ı	ı
8		(	8	H	X	h	x	^	~	ı	ı	ı	ı	ı	ı	ı
9		)	9	I	Y	i	y	‰	™	©	ı	ı	ı	ı	ı	ı
A		*	:	J	Z	j	z							ı	ı	ı
B		+	;	K	[	k	{	<	>	«	»	ı	ı	ı	ı	ı
C		,	<	L	\	l	|			ı	ı	ı	ı	ı	ı	ı
D		-	=	M	]	m	}			ı	ı	ı	ı	ı	ı	ı
E		.	>	N	^	n	~			©	ı	ı	ı	ı	ı	ı
F		/	?	O	_	o				-	-	ı	ı	ı	ı	ı

1256 Windows Arabic

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0				0	@	P	`	p	€	£	°	ذ	à	“		
1		!	1	A	Q	a	q	پ	‘	±	ف	ر	ج	”		
2		”	2	B	R	b	r	,	’	¢	²	í	â	„		
3		#	3	C	S	c	s	f	“	£	³	í	â	”	’	
4		\$	4	D	T	d	t	,	”	¤	´	و	ش	ن	ô	
5		%	5	E	U	e	u	...	·	¥	µ	ل	ص	°	’	
6		&	6	F	V	f	v	†	-	‡	§	ض	و	/		
7		’	7	G	W	g	w	‡	-	§	·	ا	×	ç	÷	
8		(	8	H	X	h	x	^	”	·	ب	ط	è	°		
9		)	9	I	Y	i	y	%	™	©	1	ة	ظ	é	ù	
A		*	:	J	Z	j	z			!	ع	ت	ê	°		
B		+	;	K	[	k	{	<	>	«	»	ث	غ	ë	û	
C		,	<	L	\	l	|	Æ	œ	¬	¼	ج	-	س	ü	
D		-	=	M	]	m	}	ج		½	ح	ف	ş			
E		.	>	N	^	n	~	ج		¾	خ	ق	î			
F		/	?	O	_	o				-	؟	ك	ï			

1257 Windows Baltic Rim

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0				0	@	P	`	p	€		°	Ą	Ś	ą	ś	
1		!	1	A	Q	a	q		´	˘	±	Į	Ń	į	ń	
2		"	2	B	R	b	r	,	’	˘	,	Ā	Ņ	ā	ņ	
3		#	3	C	S	c	s		“	£	³	ć	ó	ć	ó	
4		\$	4	D	T	d	t	„	”	¤	´	Ä	Ö	ä	ö	
5	·	%	5	E	U	e	u	…	·	μ	Å	Ö	å	ö		
6		&	6	F	V	f	v	†	-	‡	¶	Ę	Ö	ę	ö	
7		'	7	G	W	g	w	‡	-	§	·	Ē	×	ē	×	
8		(	8	H	X	h	x		”	.	Č	Ů	č	ů		
9		)	9	I	Y	i	y	‰	™	©	¹	É	Ł	é	ł	
A		*	:	J	Z	j	z			Ŕ	Ŗ	Ż	Ś	ż	ś	
B		+	;	K	[	k	{	<	>	«	»	É	Ů	é	ů	
C		,	<	L	\	l	|		¬	¼	Ğ	Ü	ğ	ü		
D		-	=	M	]	m	}			½	Ķ	Ž	ķ	ž		
E		.	>	N	^	n	~			¾	Ī	Ž	ī	ž		
F		/	?	O	_	o				Æ	æ	Ł	ß]		

Chinese Characters in the Passbook/Document Printer

Printer: One-byte mode

ESC [0 \$ q

Code	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0				0	@	P	`	p	Ç	É	ß	⌘	⌘	⌘	⌘	≡
1		!	1	A	Q	a	q	ü	æ	í	⌘	⌘	⌘	⌘	⌘	±
2		"	2	B	R	b	r	é	Æ	ó	⌘	⌘	⌘	⌘	⌘	≥
3		#	3	C	S	c	s	â	ô	ú	|	|	⌘	⌘	⌘	≤
4		\$	4	D	T	d	t	ä	ö	ñ	|	-	⌘	⌘	⌘	|
5		§	§	5	E	U	e	u	à	ò	Ñ	|	|	⌘	⌘	⌘
6		&	6	F	V	f	v	â	û	ª	|	|	⌘	⌘	⌘	÷
7		'	7	G	W	g	w	ç	ù	º	⌘	|	|	⌘	⌘	≈
8		(	8	H	X	h	x	ê	ÿ	¿	⌘	⌘	⌘	⌘	⌘	°
9		)	9	I	Y	i	y	ë	ö	¬	|	|	⌘	⌘	⌘	•
A		*	:	J	Z	j	z	è	ü	¬	|	|	⌘	⌘	⌘	•
B		+	;	K	[	k	{	ÿ	ç	¼	⌘	⌘	⌘	⌘	⌘	√
C		,	<	L	\	l	|	î	£	¼	⌘	|	|	⌘	⌘	∞
D		-	=	M	]	m	}	ì	¥	¡	⌘	|	|	⌘	⌘	²
E		.	>	N	^	n	~	Ä	ß	«	⌘	|	|	⌘	⌘	■
F		/	?	O	_	o		Ä	f	»	⌘	|	|	⌘	⌘	∩

Printer: Two-byte mode

GB xxxx encoding

ESC [n \$ q n = 1 ... 100

Code	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0				0	@	P	`	p	Ç	É	á					
1			!	1	A	Q	a	q	ü	æ						
2			"	2	B	R	b	r	é	Æ						
3			#	3	C	S	c	s	â	ô						
4			\$	4	D	T	d	t	ä	ö						
5		§	§	5	E	U	e	u	à	ò						
6			&	6	F	V	f	v	å	û						
7			'	7	G	W	g	w	ç	ù	2 Byte Codes					
8			(	8	H	X	h	x	ê	ÿ						
9			)	9	I	Y	i	y	ë	ö						
A			*	:	J	Z	j	z	è	Û						
B			+	;	K	[	k	{	ï	ç						
C			,	<	L	\	l	|	î	£						
D			-	=	M	]	m	}	ì	¥						
E			.	>	N	^	n	~	Ä	ß						
F			/	?	O	_	o		Å	f						

BIG 5 encoding**ESC [n \$ q n = 101200**

Code	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0			0						Ç	É	á					
1			!	1					ü	æ						
2			"	2					é	Æ						
3			#	3					â	ô						
4			\$	4					ä	ö						
5		§	%	5					à	ò						
6			&	6					å	û						
7			'	7					ç	ù	2 Byte Codes					
8			(	8					ê	ÿ						
9			)	9					ë	ö						
A			*	:					è	ü						
B			+	;					ï	ç						
C			,	<					î	£						
D			-	=					ì	¥						
E			.	>					Ä	ß						
F			/	?					Å	f						

A140-A24E

Symbols

A24F-A258

Various special characters

A259-A261

Chinese characters

A262-A2AE

Graphic characters

A2AF-A2B8

Arabic digits

A2B9-A2C2

Roman digits

A2C3-A2CE

Hangzhou digits

A2CF-A2E8

Latin capital letter

A2E9-A343	Latin small letters
A344-A35B	Greek capital letters
A35C-A373	Greek small letters
A374-A3BA	Zhuyin characters
A3BB-A3BF	Zhuyin diacritic characters
A440-C67E	Hanzi (5401 characters - frequently used)
C6A1-C8D4	Characters in circles and brackets, Hiragana, Katakana, Cyrillic characters, symbols, special characters
C940-F9D5	Hanzi (7652 characters - less frequently used)

Structure of the character generator

The Asian font file has the following structure:

File header
Font header 1 ... Font header n
Character pool

File header

Bytes	Contents	Name	
0000 - 0004	\$MOD\$	Identifier	
0005	blank	Separator	
0006 - 000B	yymmdd	Date	e.g. 960229
000C	blank	Separator	
000D - 0010	rrvv	Release & version	e.g. 1000
0011	blank	Separator	
0012 - 0019	a....a	File name	e.g. ND97CHIN
001A	.	Separator	dot
001B - 001D	TBF	Extension	TBF -> two-byte font
001E	blank	Separator	
001f - 0021	a.a	Length	001 = 64KB 002 = 128KB 003 = 192KB 004 = 256 KB 064 = 4 MB
0022 - 0023	xxxx	Default font number	Font number 0 is used if a setting is required at the operating panel
0024 - 002F	blank	Free	

Font header

Bytes	Data type	Name	
Administration/ emulation parameter			
0000 - 000F	ASCII	Font name	z. B. FANG SONG
0010 - 0011	int	Font number ¹	z. B. FANG SONG = 0
0012 - 0015	long	Pointer to start address	
0016 - 0019	long	First code	
001a - 001d	long	Last code	
001e - 001f		Empty	
Printer control parameter			
0020 - 0021	int	boxh	No. of vertical pixels/char. width
0022 - 0023	int	boxw	No. of horizontal pixel/char. width
0024 - 0025	int	vert_res	in dots/inch
0026 - 0027	int	hor_res	in dots/inch
0028 - 0029	int	baseline	
002a - 002b	int	printmode	
002c - 003f		Reserved	

1. see section "Font number"

GB 2312-80 / GB 5007 / GB 5199

The character set Guo Biao (GB) 2312-80 is a static 2-byte code for the People’s Republic of China. It contains a total of 6763 characters and forms the basis set for the simplified Chinese. In addition to the Chinese characters the character set Guo Biao includes the Latin, Greek and Russian alphabet, Japanese and Korean characters, and symbols and line elements.

The character sets GB 5007 and GB 5199 use partially different characters in the address area A1/A1_{hex} to A9/FE_{hex} than the character set GB2312-80. The character pool and the addressing of the Chinese characters are, however, identical.

A1A1	-	A9FE	Latin, Greek, Russian, Japanese and Korean characters, symbols, graphics
AAA1	-	AFFE	Empty
B0A1	-	F7FE	Chinese characters
F8A1	-	FEFE	Empty

Font type

The font type FANG SONG is used to represent the Chinese characters on the address area B0/A1_{hex} to FE/ FE_{hex}.

Font number

The font numbers ranging from 0 to 100 are provided for the fonts with the character addresses A1A1_{hex} to FEFE_{hex} (GB-XXXX).

The font numbers 101 to 200 should be used for character sets with an extensive addressing which may not be sequential (BIG5).

Font	Font No.
GB2312 symbols	1
GB5007 symbols	2
GB5199 symbols	3
GB... Simplified Chinese FANGSONG	10
BIG5 Traditional Chinese	101

Available Character Generators for the document printer

Description	CP15ASIA.TBF
Rev. date	1001/28.06.00
Default font	can be set on the operating panel
Contents	.
Font	Font No.
GB2312 symbols	1
GB5007 symbols	2
GB5199 symbols	3
GB.... Simplified Chinese	10
FANGSONG	
BIG5 Traditional Chinese	101

IBM Emulations

IBM 4722 Emulation

The passbook and document printer emulates the IBM 4722 printers model 1, 2, and 3. The functions of the printer model 3 are accessible only if a special protocol is used on the RS232 interface. The other modules can be operated without protocol and/or via the external interface.

The control sequences for the IBM printer 4712 are ignored.

General

The selection of the model 3 emulation is done by setting the emulation type 'IBM 4722'.

This setting automatically enables the RS232 interface with the 4722 protocol.

Interface 4722 protocol

A CRC check and a check of the transmit and status sequence bits are not carried out (message type byte).

The interface parameters are set to fixed values (except for the baud rate): 8 bits, no parity, 2 stop bits.

The setting SW 7 with/without acknowledgment handshake is made in the menu Interface Handshake DTR / XON-OFF.

Emulation

The acknowledgment of the print jobs is supplied 'n' lines before their execution to achieve a higher system performance. The data stream associated with the common error messages EJECTED and/or NO_PAPER is, however, acknowledged correctly.

The command MSG parameter 'load patches' is ignored.

Only the indicators "Programmable Indicator 1u2" are supported.

The function of loadable characters is not supported, due to different print head resolutions.

The print attributes 'overscore' and 'double height' are not supported.

The last possible print line when printing lists (unformatted) varies according to the various printing units.

Printer type	Last print line before bottom paper edge
T5023 / 4722	approx. 1 mm
IBM 4722	approx. 6.5 mm
IBM 9068 / 4722	approx. 5 mm
Olivetti / 4722	

Operation

When the 4722 emulation is enabled, the STOP and EJECT keys have the same function as the STOP key of the 4722 printer. Exception: If an error occurs, the printer need not be switched of (see IBM4722). The STOP key can be used to initiate a reset, which automatically activates the ONLINE status.

When the USER 2 key is pressed at power-on, the 4722 emulation will be replaced by the emulation set with the menu item EMULATION Type2.

The 'LOAD_PAPER' status does not occur.

Variable initialisation parameters 4722 emulation:

IBM4722 Switch - Electronic Board	T5023/5023+ Setting
IBM4722 Switch 1 Audible Alarm	Not supported
IBM4722 Switch 2 Zero Slash	Not supported
IBM4722 Switch 3 Automatic Line Feed	Emulation menu LF (LF = LF)
IBM4722 Switch 4 Reserved	
IBM4722 Switch 5 Character Set	Character set 2
IBM4722 Switch 6 Automatic CR	Emulation menu CR (CR = CR)
IBM4722 Switch 7 Reserved	Character set 2
IBM4722 Switch interface card	
SW 1..3 Baud rate	Interface menu 9600,4800,2400,1200 (9600)
SW 7 Reserved	Interface menu Protocol (DTR) Emulation menu Multi Part (OFF) Emulation menu Typeface DQ, Roman, Sans Serif (DQ-Sans Serif)



It is normally not necessary to set the operating panel parameters in the 4722 emulation.

Fixed initialisation parameters 4722 emulation:

Parameters	T5023/5023+ parameter in the 4722 emulation
Top of form position	Line 2 (6 LPI)
Char. density	10 CPI
Char. width	Normal
Country	USA
Left edge	Column 1 (10 CPI)
Ref. edge	Left

IBM Proprinter XL24 Emulation

General

The selection of the emulation is done using menu item Type 'Prop.XL24'.

This emulation can be used with all interfaces.

Emulation

The function of loadable characters is not supported, due to different print head resolutions.

The print attributes 'overscore' and 'double height' are not supported.

Operation

The operation and the emulation parameters are identical with the Epson ANSI emulation.

Initialisation parameters

All parameters that can be set in the relevant emulation menu are taken into consideration during the initialisation.

Range of Commands for the ProprinterXL24 and 4722

Summary of the command sequences T5023 Interpreter for 4722 (IBM)

ASCII	Decimal	Hex	Function	4722	XL24	Default	Remark
NULL	0	0	ignor	X	X		
BEL	7	7	Signal tone	X	X	is ignored	
BS	8	8	Backspace	X	X		
HAT	9	9	Horizontal tabulation	X	X		
LF	10	0A	Line feed	X	X	at 1/6" (adjustable with CR)	
VT	11	0B	Vertical tabulation	X	X		
FF	12	0C	Sheet ejection/page feed	X	X	2/6" from upper sheet margin adjustable with XL24	
CR	13	0D	Carriage Return	X	X	CR (adjustable with LF)	
SO	14	0E	Switching on elongated printing for one line	X	X	Switched off	
SI	15	0F	Switching on condensed printing	X	X	Switched off	
DC1	17	11	Switching on printer logically (Online)	X			is ignored
DC2	18	12	Switching off condensed printing	X	X		
DC3	19	13	Switching off printer logically (Offline)	X	X		is ignored
DC4	20	14	Switching off elongated printing	X	X	Switched off	
CAN	24	18	Delete line (Cancel)	X	X		
DEL	127	7F	ignor (like NULL)	X			

ASCII	Decimal	Hex	Function	4722	XL24	Default
ESC 0	27 48	1B 30	Select 1/8 line distance	X	X	
ESC 1	27 49	1B 31	Select 7/72 line distance	X	X	
ESC 2	27 50	1B 32	Select 1/6 variable line distance ESC A	X	X	
ESC 3 (n)	27 51 n	1B 33 n	Select n/216 (n/180) line distance	X	X	
ESC 4	27 52	1B 34	Set Top of Form (EJECT)	X	X	
ESC 5 (n)	27 53	1B 35	Set Auto LF Mode on CR - ON/OFF	X	X	Operating panel
ESC 6	27 54	1B 36	Character set 2 (Extended)	X	X	On
ESC 7	27 55	1B 37	Character set 1 (Standard)	X	X	Off
ESC :	27 58	1B 3A	Set 12 CPI	X	X	
ESC A (n)	27 65 n	1B 41 n	Select n/72 text line spacing	X	X	
ESC B ... NUL	27 66 ... 0	1B 42 ... 00	Define/delete vertical tabulators	X	X	None
ESC C NUL (n)	27 67 0 n	1B 43 00 n	Define page length in inch (document/journal)	X	X	11;3"/12" (*1)
ESC C (n)	27 67 n	1B 43 n	Define page length in lines (document/journal)	X	X	11;3"/12" (*1)
ESC D ... NUL	27 68 ... 0	1B 44 ... 00	Define/delete horizontal tabulators	X	X	All 8 characters
ESC E	27 69	1B 45	Switching on bold printing	X	X	Off
ESC F	27 70	1B 46	Switching off bold printing	X	X	
ESC G	27 71	1B 47	Print quality NLQ ON	X	X	Off
ESC H	27 72	1B 48	Print quality NLQ OFF	X	X	
ESC I (n)	27 73 n	1B 49 n	Font selection:text, near letter, download	X	X	
ESC J (n)	27 74 n	1B 4A n	n/216 line feed	X	X	
ESC K (n) (m)	27 75 n m	1B 4B n m	Switching on graphics mode single density	X	X	
ESC L (n) (m)	27 76 n m	1B 4C n m	Switching on graphics mode double density	X	X	

ASCII	Decimal	Hex	Function	4722	XL24	Default
ESC N (n)	27 78 n	1B 4E n	Ignore setting lower margin	X		No margin
ESC O	27 79	1B 4F	Ignore deleting lower margin	X	X	
ESC P n	27 80	1B 50	Proportional On Off		X	Off
ESC Q (n)	27 81 n	1B 51 n	Deselect Printer		X	
ESC R	27 82 n	1B 52 n	Reset all Tabstops (vert. and hor.)	X	X	
ESC S (n)	27 83 n	1B 53 n	Switching on superscript/subscript	X	X	Off
ESC T	27 84	1B 54	Switching off superscript/subscript	X	X	
ESC U (n)	27 85	1B 55	Switching on/off unidirectional print mode	X	X	Bidirectional
ESC W (n)	27 87 n	1B 57 n	Switching on/off elongated printing	X	X	Off
ESC X (n)(m)			Setting left and right margin	X	X	
ESC Y (n) (m)	27 89 n m	1B 59 n m	Switching On graphics mode double density and double speed 1/72 vert.	X	X	
ESC Z (n) (m)	27 90 n m	1B 5A n m	Switching On graphics mode quadruple density 1/72 vert.	X	X	
ESC]	2793	1B 5D	Reverse Line Feed (should not be used)	X	X	
ESC ^ n	27 94	1B 5E	Print all single character	X	X	
ESC _ n	27 95	1B 5F	Overscore ON OFFt	X	X	
ESC [F	27 91 70	1b 5b 46	Sheet feeder		X	
ESC [F c1 c2 nn..nn	27 91 70	1b 5b 46	Page Presentation Media	X		
ESC [J c1 c2 n ... n	27 91 74	1b 5b 4A	Set single Line Density (SSLD)	X		
ESC [c c1 c2	27 91	1b 5b 63	Message	X		
ESC [\ n1 n2	27 91 92	1b 5b 5C	Set graphical line distance		X	
ESC [@ n1 n2	27 91 64	1b 5b 40	Double height/width		X	
ESC [g n1 n2 m	27 91 95	1b 5b 67	Graphics		X	
ESC d (n) (m)	27 100 n m	1B 64 n m	Horizontal positioning (relative)		X	

(*2)

(*1)

(*1)

(*2)

(*2)

(*2)

ASCII	Decimal	Hex	Function	4722	XL24	Default (*3)
ESC SO	27 14	1B 0E	Switching on elongated printing for one line		X	Switched off
ESC SI	27 15	1B 0F	Switching on condensed printing		X	Switched off
ESC - (n)	27 45 n	1B 2D n	Switching on/off underlining		X	Switched off
ESC * (s)(n)(m)	27 42 s n m	1B 2A s n m	Select graphic mode		X	
ESC =			Download	X	X	(*2)
ESC \ c1 c2 n..n	27 92 n n	1B 5C n n	Print all continuous	X	X	(*2)
ESC BEL L	27 07 76	1b 07 4c	Switch over to load function			(*3)

(*1) Printers with IBM 4722 emulation do not support this control code.

(*2) Is ignored

(*3) Original printing units do not support the control code for special function extensions.

Olivetti PR50 Emulation

General

The selection of the emulation is done using the menu type 'Olivetti'. This emulation can be used with all interfaces.

Emulation

The function of loadable characters is not supported, due to different print head resolutions.

The print attribute 'overscore' is not supported.

Initialization parameter

All parameters that can be set in the relevant emulation menu are taken into consideration during the initialisation.

Range of Commands for the OLIVETTI PR50

ASC II	Hex	Function	Remark
LF	0A	Line feed forward	
FF	0C	Form Feed	
CR	0D	Carriage return	
ESC # n	1B 23 ..	Assign reference for ESC L nnn	
ESC & nn	1B 26 ..	Elementary vertical spacing	
ESC ´ n	1B 27 ..	Set document type	
ESC (	1B 28	Bold Face	
ESC)	1B 29	Cancel Bold Face	
ESC * n	1B 1A	Underline	
ESC +	1B 2B	Cancel underline	
ESC -	1B 2D	Measure document length	
ESC .	1B 2E	Select automatic operator booking mode	
ESC / ..	1B 2F ..	Set absolute vertikcal position in elementary steps	
ESC 0	1B 30	General reset	
ESC 1 p ..	1B 31 70 ..	Set B.I.M.	
ESC 2	1B 32	Reset B.I.M.	
ESC 3	1B 33	Double width	
ESC 4	1B 34	Cancel double width	
ESC 7	1B 37	Line feed backward	

ASC II	Hex	Function	Remark
ESC <	1B 3C	Print pitch 10 cpi	
ESC =	1B 3D	Print pitch 12 cpi	
ESC >	1B 3E	Print pitch 16.6 cpi	
ESC ?	1B 3F	Proportional spacing	
ESC H ..	1B 48 ..	Set absolute horizontal position	
ESC I ..	1B 49 ..	Set relative vertical position	
ESC J ..	1B 4A ..	Set left margin	
ESC L ..	1B 4C ..	Set absolute vertical position	
ESC M ..	1B 4D ..	Set bottom of form "BOF"	
ESC O	1B 4F	Eject document	
ESC Q ..	1B 51 ..	Define document length	
ESC R ..	1B 52 ..	Select graphic font	
ESC S 5	1B 53 35	Select printer device	
ESC S ..	1B 53 ..	Measure document length: answer	
ESC T ..	1B 54 ..	Define top of form "TOF"	
ESC U ..	1B 55 ..	Book operator	
ESC W 0	1B 57 30	Cancel double height	
ESC W 1	1B 57 31	Double height	
ESC X ..	1B 58 ..	Set relative horizontal position	
ESC Y D ..	1B 59 44 ..	Set vertical magnetic device	
ESC Y E ..	1B 59 45 ..	Set horizontal magnetic device	
ESC Z	1B 5A	Request for primary ID	
ESC [..	1B 5B ..	Select character set	
ESC \	1B 5C	Record and check magnetic stripe	
ESC]	1B 5D	Magnetic read	
ESC ^ 0	1B 5E 30	Change emulation	
ESC _	1B 5F	Select manual operator booking mode	
ESC ` ..	1B 60 ..	Superscript - Subscript	
ESC d	1B 64	Double height and double width	
ESC e	1B 65	Cancel double height and double width	
ESC i	1B 69	Request for basic machine configuration	
ESC j	1B 6A	Status request	
ESC l	1B 6C	Reset error	
ESC m ..	1B 6D ..	Select character generator	
ESC n	1B 6E	Olivetti controlled selection	
ESC p ..	1B 70 ..	Printer configuration	
ESC r x	1B 72 ..	Answer to book operator command	
ESC r x	1B 72 ..	Synchronous basic machine status	
ESC t ..	1B 74 ..	data to be recordet on magnetic stripe	
ESC {	1B 7B	Cancel superscript/subscript	
ESC | A ..	1B 7C 41 ..	Define offset in elementary steps	
ESC | B ..	1B 7C 42 ..	Define document width in elementary steps	
DEL	7F	Clear print memory	
FS	1C	Read returned magnetic bar data ending marker	
FS &	1C 26	Set chiniese mode	
FS .	1C 2E	Cancel chiniese mode	
FS g	1C 67	Cancel full angle ascii code	
FS k	1C 6B	Set full angle ascii code	
GS	1D	Magnetic bar data write ending marker	

Character Sets for the Olivetti Emulation



The character set required from the Olivetti emulation are marked with a 'OL' ending (e. g. 'CP1250OL.FNT' or 'CP_437OL.FNT').

The character set required from the Olivetti emulation contains both character sets for the Epson-ANSI emulation and the following character sets required for the Olivetti emulation. Using the 'normal' character sets the operating panel settings and the command sequences to select the character sets will be ingnored.

Character Sets Olivetti (IBM*) Emulation (operating panel parameter and command sequences ESC [nnn])

*IBM Proprinter emulation can only be set at the operating panel.

nnn	National Variants
000	International
010	International
020	Germany
030	Portugal
040	Spain 1
050	Denmark/Norway
060	France
070	Italy
080	Sweden/Finland
090	Switzerland
100	Great Britain
110	USA ASCII
140	Greece
150	Israel
170	Spain 2
200	Yugoslavia

nnn	National Variants
410	STD31 – Olivetti TCV370
500	Canada
510	SDC
520	Turkey
711	PC Denmark/Norway
712	PC Denmark OPE
771	PC – 210 Greece
701	PC – 220 Spain 2
700	PC – 437 International
740	PC – 850 Latin 1
720	PC – 860 Portugal
781	PC – 862 Israel
680	OLIVETTI – UNIX
600	Code Page 1252 (ISO 8859/1 Latin 1)
*	PC – 852 Latin 2

* only be set at the operating panel

Paper Specifications

The document printer has a document print station which can process single documents, multi-copy documents (document sets) and passbooks. A magnetic stripe reader (MSR) can be installed as an option at the document print station.

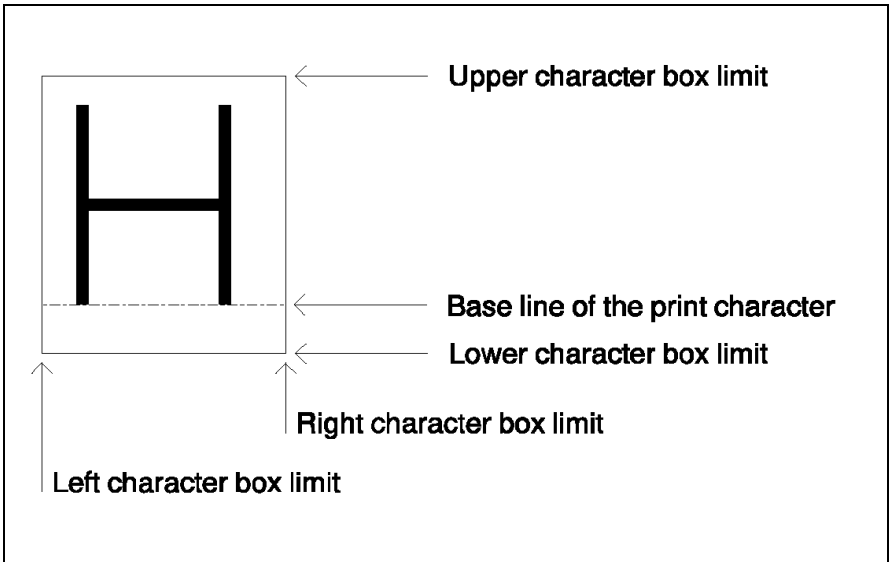
The document printer is operated with an automatic print head guidance system for printing passbooks and documents.

For the right-angle orientation of the documents and passbooks towards the print mechanism the documents/passbooks are aligned at the right-hand side of the document chute assembly and at the front of the document stop. Transmitted light barriers are located at these positions. Another transmitted light barrier located inside the document feeder allows printing with footer detection.

Reference Lines

The safety distances described in this document use the outer document and passbook edges as well as the staggered edges and folds as reference lines. The reference lines for the print characters are defined by the represented character box.

The character box is a rectangle where the width is predefined by the character pitch selected (e.g. 1/10 inches for 10 characters/inch). The height of the character box is defined by the vertical distance between the top and bottom needle (3.5mm for the document printer). Any dot within this character box can be printed (blackened).



b = width of the character pitch (e.g. 1/10" for 10 CPI)

All dimensions shown in the illustration are in millimeter.

For detailed information see the "Paper specifications" on the CD-ROM.

Error messages

Status messages

Status	Description / Removal
ONLINE NO_PAPER	Online status, no paper inserted
ONLINE PAPER	Online status, paper drawn in
DATA NO_PAPER	STOP status, data in input buffer, no paper inserted
DATA PAPER	STOP status, data in input buffer, paper inserted
STOP NO_PAPER	STOP status, input buffer empty, no paper inserted
STOP PAPER	STOP status, input buffer empty, paper inserted
LOAD PAPER	Paper request by data in print buffer

Status messages (Bootstrap loader activated)

Status	Description
LOAD	Bootstrap loader activated
NO PROGRAM	Bootstrap loader activated, firmware missing
NO_CHARACTER_GENERATOR	Bootstrap loader activated, character generator missing
PROGRAMMING	Memory area is programmed
PROGRAMMING_TIMEOUT	Timeout when loading data segments
TRANSM_ERROR	Data transmission error when loading data segments
PROG_ERR	Programming error when loading memory chip

Malfunctions



Some error messages contain numerical codes with additional information to the cause of error. This additional information is only for the service personnel and can be called up by pressing the VALID key . The service information will disappear after some time.

Error	Cause / Possible action	Service information: No./Meaning
PAPER LENGTH	Document too short Use a longer document	
PAPER JAM	Paper jam, paper blocked, paper can not be ejected Check paper transport paths, remove remainder of paper	00...10
PAPER WIDENESS	Print job extends over right-hand paper edge Feed in larger paper	
PARITY ERROR	Serial interface Parity Error Check settings of printer or system	
OVERRUN ERROR	Serial interface Parity Error Check settings of printer or system	
FRAMING ERROR	Serial interface, serial interface Overrun Error Check handshake protocol printer or system, check cable	
BREAK	Serial interface, Switching system ON/OFF, push/pull interface cable, produced by the system driver	

Error	Cause / Possible action	Service information: No. / Meaning
WRONG IF_TYPE	The Interface type set in the parameter menu cannot be activated Set another interface type: check whether the correct optional interface board is installed; check whether the optional interface board is correctly inserted.	
WRONG ORDER	Incorrect control sequence or character which cannot be printed Check the system driver, load different emulation firmware into the printer	The printer has loaded an emulation A, however the received data is for an emulation B
JOURNAL BUFFER FULL	Electronic Journal full Start a journal printout and delete journal memory	
COVER OPEN	Printer cover open Close Printer cover	

Error	Cause / Possible action	Service information: No. / Meaning
FIRMWARE ERROR	Internal firmware error Check firmware release, if necessary install new	16 IMT syntax error 32 Internal ET syntax error 33 ET AEQ MSG syntax error 34 ET Timeout mechanic 35 ET Timeout interface 36 ET Timeout CPPT 64 CPPT syntax error 80 ECT syntax error 96 HMPT syntax error 112 VMT syntax error
ELECTR ERROR (ELECTRONIC ERROR)	Hardware error in the electronic	00 EE-PROM

Error	Cause / Possible action	Service information: No. / Meaning
CARRIER ERROR	<p>Print head drive Hardware error</p> <p>Check area around the platen for foreign bodies,</p> <p>Light rail dirty (clean),</p> <p>Carrier drive, drive belt, motor, plug, carrier motor, print head not plugged,</p> <p>Sensor in print head defect (change print head), print head cable not plugged or defect,</p> <p>Electronic defect</p>	<p>01 Wrong needle frequency</p> <p>02 Print command without print blocks</p> <p>03 Overflow of the proceed profile table</p> <p>04 Print outside print area</p> <p>05 Error at scanning basic setting</p> <p>06 Error at 'Go to target' basic setting</p> <p>07 Expected photo sensor interrupt not received</p> <p>08 Motor error at measuring drive over light rail</p> <p>09 Measuring error light rail over 5 mm</p> <p>10 Motor error at 'Search left paper edge'</p>
DETECT ERROR	Carrier Error at paper edge measuring	
HEAD HOT	<p>The print head is too hot</p> <p>Rests between printing of the lines</p> <p>When the print head is cold, print head or cable defect</p>	

Error	Cause / Possible action	Service information: No. / Meaning
POWERSUPPLY HOT	The power supply is too hot Rests between printing of the lines	
TRANSP ERROR (TRANSPORT ER- ROR)	Document feed error Control motor blocked (platen, guidance hook, MSR pressure, MICR pressure) Control motor not plugged, electronic defect	00 Motor control 01 Motor transport
FEEDER ERROR	Feeder hardware error	
MICR ERROR	Magnetic ink character reader	
MSR WRONG ORDER	Magnetic stripe reader	01 Wrong sequence 02 Wrong parameter 03 Wrong character 04 Wrong character length

Error	Cause / Possible action	Service information: No. / Meaning
MSR ERROR	Magnetic stripe reader hardware error Change unit	01 General hardware error 02 Head position MSR cleaning function 10 Too many writing repetitions 11 Control reading error 12 Too many reading repetitions 13 Read block 1 14 LRC error 15 Parity error 16 No data found 17 No start character found 18 Wrong flux change distance 19 No end character found 20 Magnetic track interrupted

Description of the physical interface

The physical interface of the document printer makes serial asynchronous data transmission possible. Optional the document printer can be retrofit with an Centronics interface.

The following sections lists the performance characteristics of the interfaces.

General

The document printer comes standard with a serial asynchronous interface.

You can control data transmission with the XON / XOFF protocol and the hardware handshaking DTR.

Optionally, a secondary serial interface, a Centronics card, a Ethernet card or a B-Loop card can be installed in the document printer.

Parameters for the active interface are defined in more detail in a menu.

Handshaking protocols

Data transmission between the host and the printer is controlled by the handshaking protocol.

Hardware Handshake via the DTR Signal

In the DTR/Busy protocol the printer signals by the activated signals DTR and RTS its readiness to receive data to the connected device.

DTR and RTS are activated:

1. When the printer has been switched on (power on).
2. When the status changes from STOP to ONLINE.
3. When the available input buffer area of the printer accept new data (at least 1 kByte free input buffer) after having been disabled (less than 512 Byte free input buffer).

DTR and RTS are deactivated:

1. When the status changes from ONLINE to STOP (stop key pressed or printer error appears).
2. When the available input buffer area is less than 512 bytes.

By the activated signal CTS the connected device signals to the printer to send data.

Software handshake with XON/XOFF protocol

In the XON/ XOFF protocol the printer signals to the connected device the readiness to receive data by sending an X-ON. X-OFF signals that the printer is not ready to receive data.

X-ON is transmitted

1. When the printer has been switched on (power on).
2. When the status changes from STOP to ONLINE.
3. When the available input buffer area of the printer accept new data (at least 1 kByte free input buffer) after having been disabled (less than 512 byte free input buffer).

X-OFF is transmitted

1. When the status changes from ONLINE to STOP (stop key or printer error).
2. When the available input buffer area is less than 512 bytes.

By the activated signal CTS the connected device signals to the printer to send data.

Software handshake with X-ON/X-OFF 2 protocol

The difference between the X-On/X-OFF 2 protocol and the X-On/X-OFF protocol is that the printer transmitt data to the connected device without CTS-check.

Interface data serial interface

Signal level

RS-232

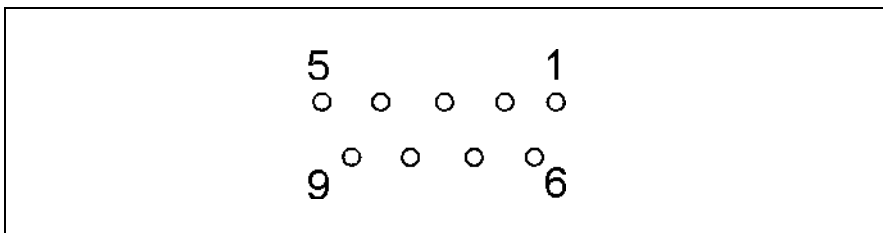
Data format

Baud Rate	2400, 4800, 9600, 19200
Data word length	7/ 8 Bit
Stop bits	1/ 2
Parity	even/ odd/ none

Parameter selection is performed via the operating panel.

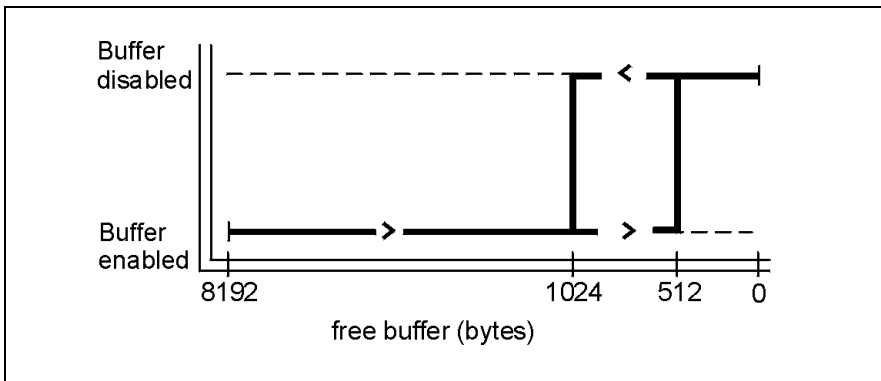
Type of connector

The interface of the document printer is equipped with a 9-pin Cannon plug:



Buffer control RS- 232

The document printer has a 8192 byte print buffer, whose size cannot be changed. If there are less than 512 bytes of buffer free no more data is accepted and the interface is disabled. Only when there are more than 1024 bytes available in memory, the printer is ready to receive data again. Depending on the interface, the line is controlled by the DTR/CTS hardware handshaking or by the XON/XOFF software protocol.



Error handling

Errors when receiving data:

Error / status message	Reaction
BREAK	Warning
FRAMING ERROR	Warning
PARITY ERROR	Warning
OVERRUN ERROR	Error

Signal description and connector assignment RS- 232 interface

Pin 05 SG – Signal Ground

Data lines

Pin 03 TD Transmitted Data
Serial data output printer --> Host

Pin 02 RD Received Data
Serial data input printer <-- Host

Control lines

Pin 08 CTS – Clear To Send
Entry

In the DTR/Busy and XON/ XOFF protocol the 'ON' status signals to the connected device (signal receiver=printer) that it is ready to receive data. Not used in the XON/ XOFF 2 protocol.

Pin 04 DTR – Data Terminal Ready
Exit

In the DTR/Busy protocol the 'ON' status signals to the connected device (signal receiver=host) readiness to receive data.

In the XON/ XOFF protocol DTR and RTS reflects back the operating readiness of the printer:

– DTR/RTS active: Online

– DTR/RTS inactive: STOP (STOP key and operating interruption)
or ERROR

Cable connection document printer - PC

Pin-No.	Document printer 9-pin plug	Cable	Pin-No.	PC 9-pin plug
1	Printer switched on (+12V)	==>	1	DCD Data Carrier Detect
2	RD Received Data Serial data entry printer	<==	3	TD Transmitted Data
3	TD Transmitted Data Serial data exit printer	==>	2	RD Received Data
4	DTR Data Terminal Ready exit In the DTR/Busy protocol the 'ON' status signals the connected device (signal receiver) the readiness to receive data	==>	6	DSR Data Set Ready
5	SG-Signal Ground	<==>	5	SG-Signal Ground
6	DSR Data Set Ready	<==	4	DTR Data Terminal Ready
7	RTS Request to Send In the DTR/Busy protocol the 'ON' status signals the connected device (signal receiver) the readiness to receive data	==>	8	CTS Clear to Send

Pin-No.	Document printer 9-pin plug	Cable	Pin-No.	PC 9-pin plug
8	CTS Clear to Send Entry The 'ON' status signals the connected device (signal receiver) the readiness to receive data to (Not interpreted by the printer if the XON/XOFF 2 protocol is selected.)	<==	7	RTS Request to Send
9			9	

Interface data external Centronics interface

With the parameter 'centronics' of the interface menu the Centronics interface can be set to the ECP mode (centronics=ECP) or not (centronics=printer). If the parameter 'centronics' is set to 'printer' the Centronics interface can only be work in the compatibility mode.

The parameter 'centronics' also controls how to set the signal 'PError' from the printer (see section "Cable connection" and "Signal description printer side in the compatibility mode and ECP-mode" of the Centronics interface).

Centronics modes

Compatibility mode and ECP mode correspond to the norm IEEE P1284 D2.

Type of connector

The interface of the document printer have a 25-pin D-SUB plug at the host side and a 36-pin Centronics plug at the printer side.

Receive buffer

The size of the receive buffer is 8 kByte.

Cable connection

Pin-No. Host (1284-A) 25-pin D-SUB plug	Pin-No. Printer (1284-B) 36-pin Centronics plug	Signal description
1	1	nStrobe
2	2	Data 1
3	3	Data 2
4	4	Data 3
5	5	Data 4
6	6	Data 5
7	7	Data 6
8	8	Data 7
9	9	Data 8
10	10	nAck
11	11	Busy
12	12	PError
13	13	Select
14	14	nAutoFd
15	32	nFault
16	31	nInit
17	36	nSelectIn
18	19	Signal Ground (nStrobe)
19	20, 21	Signal Ground (Data 1, Data 2)
20	22, 23	Signal Ground (Data 3, Data 4)
21	24, 25	Signal Ground (Data 5, Data 6)
22	26, 27	Signal Ground (Data 7, Data 8)
23	29	Signal Ground (Busy, nFault)
24	28	Signal Ground (PError, Select, nAck)

Pin-No. Host (1284-A) 25-pin D-SUB plug	Pin-No. Printer (1284-B) 36-pin Centronics plug	Signal description
25	30	Signal Ground (nAutoFd, nSelectIn, nInIt)
	16	Logic Ground
	17	Chassis Ground
	18	Peripheral Logic High (+5V)
	15, 33-35	Not defined

Signal description printer side (Centronics plug) in the compatibility mode and ECP-mode

Pin-No.	Source	ECP-Mode	Compatible Mode
1	Host	HostClk	nStrobe
2	Bidirectional	Data 1 (LSB)	Data 1 (LSB)
3	Bidirectional	Data 2	Data 2
4	Bidirectional	Data 3	Data 3
5	Bidirectional	Data 4	Data 4
6	Bidirectional	Data 5	Data 5
7	Bidirectional	Data 6	Data 6
8	Bidirectional	Data 7	Data 7
9	Bidirectional	Data 8 (MSB	Data 8 (MSB
10	Printer	PeriphClk	nAck
11	Printer	PeriphAck	Busy
12	Printer	nAckReverse	PError
13	Printer	Xflag	Select
14	Host	HostAck	nAutoFd
15		Not defined	Not defined
16		Logic Grd	Logic Grd
17		Chassis Grd	Chassis Grd
18	Printer	Peripheral Logic High	Peripheral Logic High
19		Signal Ground (nStobe)	Signal Ground (nStobe)
20		Signal Ground (Data 1)	Signal Ground (Data 1)
21		Signal Ground (Data 2)	Signal Ground (Data 2)
22		Signal Ground (Data 3)	Signal Ground (Data 3)
23		Signal Ground (Data 4)	Signal Ground (Data 4)

Pin-No.	Source	ECP-Mode	Compatible Mode
24		Signal Ground (Data 5)	Signal Ground (Data 5)
25		Signal Ground (Data 6)	Signal Ground (Data 6)
26		Signal Ground (Data 7)	Signal Ground (Data 7)
27		Signal Ground (Data 8)	Signal Ground (Data 8)
28		Signal Ground (PErrror, Select, nAck)	Signal Ground (PErrror, Select, nAck)
29		Signal Ground (Busy, nFault)	Signal Ground (Busy, nFault)
30		Signal Ground (nAutoFd, nSelectIn, nInit)	Signal Ground (nAutoFd, nSelectIn, nInit)
31	Host	nReverseRequest	nInit
32	Printer	nPeriphRequest	nFault
33		Not defined	Not defined
34		Not defined	Not defined
35		Not defined	Not defined
36	Host	1284 Active	nSelectIn

Description of the signals**HostClk/nStrobe****(Host driven)**

Compatibility Mode: Set active 'low' to transfer data into printer's input latch. Data is valid while nStrobe is low.

ECP Mode: Used in a closed-loop handshake with PeriphAck to transfer data or address information from the host to the printer.

Data 1 ... Data 8

Compatibility Mode: Forward channel data.

ECP Mode: Host to the printer or printer to host address or data.

PeriphClk/nAck**(Printer driven)**

Compatibility Mode: Pulsed 'low' by the printer to acknowledge transfer of a data byte from the host.

ECP Mode: Used in a closed-loop handshake with HostAck to transfer data from the printer to the host.

Epson ANSI: The signal nAck is used to acknowledge the data byte from the host. Additional nAck is set to zero for a short time if the the online status is restored.

PeriphAck/Busy**(Printer driven)**

Compatibility Mode:

Driven 'high' to indicate that the printer is not ready to receive data.

ECP Mode:

The printer uses this signal for flow control in the forward direction. PeriphAck also provides a ninth data bit used to determine whether command or data information is present on the data signals in the reverse direction.

Epson ANSI:

Busy = 0: STOP status and printer ready
Busy = 1: STOPstatus , Error or printer not ready**nAckReverse/PError****(Printer driven)**

Compatibility Mode:

Driven 'high' to indicate that the printer has encountered an error in its paper path.

ECP Mode:

The printer drives this signal 'low' to acknowledge nReverseRequest. The host relies upon nAckReverse to determine when it is permitted to drive the data signals.

Epson ANSI:

The signal nFault is not activ at PError but in the global printer status 'ERROR' it is activ.

Centronics = ECP

PError is set to status that means PError is activ if the special printer message NO_PAPER is send to the system.

Centronics = printer

PError is set to error that means PError only set activ if data is send to the printer without paper inside.

XFlag/Select**(Printer driven)**

Compatibility Mode: Set 'high' to indicate that the printer is on-line.

ECP Mode: Used by the printer to reply to the requested extensibility byte sent by the host during the negotiation phase.

HostAck/nAutoFd**(Host driven)**

Compatibility Mode: The interpretation of this signal varies from printer to printer. Set 'low' by host to put some printers into auto-line feed mode.

ECP Mode: The host drives this signal for flow control in the reverse direction. It is used in an interlocked handshake with PeriphClk. HostAck also provides a ninth data bit used to determine whether command or data information is present on the data signals in the forward direction.

Peripheral Logic High**(Printer driven)**

Set 'high' to indicate that all other signals sourced by the printer are in a valid state.

nReverseRequest / nlnit

Compatibility Mode: Pulsed 'low' to reset the interface and force a return to Compatibility Mode idle phase.

ECP Mode: This signal is driven 'low' to place the channel in the reverse direction.

nPeriphRequest / nFault (Printer driven)

Compatibility Mode:	Set 'low' by the printer to indicate that an error has occurred.
ECP Mode:	The printer may drive this pin 'low' to request communications with the host. The request is merely a 'hint' to the host; the host has ultimate control over the transfer direction.
Epson ANSI:	nFault = 0: ERROR status nFault = 1: ONLINE and STOP status

1284 Active / nSelectIn (Host driven)

Compatibility Mode:	Set 'low' by host to select the printer.
ECP Mode:	Driven 'high' by the host while in ECP Mode. Set 'low' by the host to terminate ECP Mode and return the link to the Compatibility Mode.

Glossary

ANSI

(American National Standards Institute)

Standards institute in the USA, similar to the DIN institute in Germany.

Antiqua fonts

Type fonts with serifs, for example, Bookman, Garamond, Times. These fonts are especially suitable if large amounts of text are to remain easily legible.

ASCII

(American Standard Code for Information Interchange)

This code is internationally standardized and also known in Germany as ISO 7-bit code. It defines a character set code used to exchange data between data processing devices. Using the 7 bits of the ASCII code 128 characters can be written (alphabet in upper and lower case letters, figures, special and control characters).

Baud

Measuring unit for the specification of the transfer rate of data expressed in bits per second (for example, 300 baud = 300 bits per second).

Control characters

A non-representable ASCII character to control printer functions (control code).

Characters transferred from the central unit to a peripheral device to initiate certain functions there are also described as control characters or control bytes.

Document

Form on which data is first recorded in manual or mechanical form. Data carriers used for mechanical data processing (mechanical document) such as plain language documents, marking documents, labels, etc. are also called documents.

Document processing

Name of the processing of single documents.

Font

The complete character set of a type font in one size.

Serial interface

During serial data transfer each bit is transferred individually and consecutively. The serial interface is also known under the names V. 24 or RS-232-C.

Advantages:

possibility of checking correct transfer by means of a parity check of the received data word; also a considerably longer data cable than for the parallel interface can be used.

Serifs

In antiqua type fonts small horizontal lines on the top and bottom of some letters. When classifying fonts a distinction is made between fonts with and without serifs.

Examples of fonts with serifs: Bookman, Palatino, Times.

Examples of fonts without serifs: Helvetica, Avant Garde, Universe.

Syntax

General: the teaching on sentence structure (in the language). The syntax of a (programming) language describes the structure of the language determined by means of the rules of 'grammar' without considering the meaning (semantics) or sense.

Typography

Description of the arrangement of a printed paper including the selection of the type font, type size and distribution of space.

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